Yellowstone For All:
Creating an immersive, universal design experience at Mammoth Hot Springs

by

Rachel A. Cross

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture and Regional & Community Planning
College of Architecture, Planning and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2020

Approved by:

Major Professor
Jessica Canfield

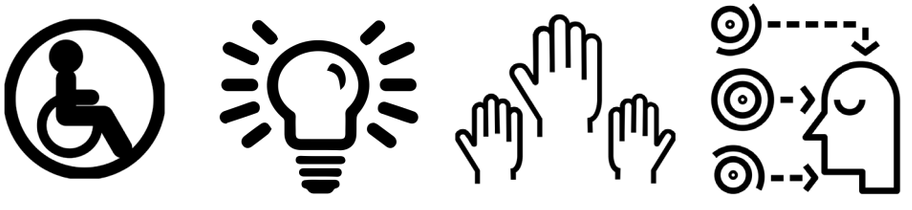
Copyright

Abstract

National Parks, including Yellowstone, allow people to escape the hustle and bustle of urban life by providing opportunities for peace, restoration, and recreation within a place dedicated to the preservation of natural systems. National Parks are a popular destination as seen in the continual rise of visitation rates. Yellowstone National Park doubled its number of annual visitors from 3.6 million people in 1985 to 7.2 million people in 2015 (National Geographic 2016). Though, as National Parks continue to increase in popularity, visitors with disabilities are not getting a fully immersive experience as compared to those who are non-disabled. In the U.S. approximately 85.3 million or 27.2% of the population has a disability (Taylor 2018). Universal design principles can help create more inclusively designed spaces for all to enjoy, and especially for those with physical mobility, auditory, visual disabilities, neuro-developmental, or neuro-cognitive disorders (Dillon and Green 2019). In Yellowstone National Park, there are several popular tourist areas, including Mammoth Hot Springs, with accessible routes. However, these areas lack necessary elements for providing a fully immersive and inclusive experience. The goal of this projective design research is to illustrate how an immersive, universal visitor experience can be created at Mammoth Hot Springs in Yellowstone National Park. To inform how universal design strategies can be applied at Mammoth Hot Springs, this research first reviews and compares notable federal acts and professional guidelines, including: the Americans with Disabilities Act, the Architectural Barriers Act, the Rehabilitation Act of 1973, ASLA's Universal Design, the Accessibility Guide to Yellowstone, Programmatic Accessibility Guidelines for National Park Service Interpretive Media, and Visitor Use Management Framework. Next, design precedents from other national, state and public parks are analyzed to learn what effective universal design strategies are being used. Interviews are conducted with subject matter experts, including the accessibility technician of Yellowstone National Park and accessibility coordinator for Grand Teton National Park. Collectively, these findings inform the development of an expanded set of universal design guidelines, specific for use in National Parks. The guidelines are organized into four approaches: accessibility, enrichment, engagement, and multi-sensory experience. To illustrate the application of the expanded design guidelines, a projective site design is created for Mammoth Hot Springs, showing how the site can provide a more immersive and inclusive experience for all.

YELLOWSTONE FOR ALL:

Creating an immersive, universal design experience at Mammoth Hot Springs



Rachel A. Cross

2020

ACKNOWLEDGMENTS:

To my dad, you opened my eyes to the need for inclusively designed spaces. You challenged me to look at the flaws in design, before I even considered it a profession. You continued to be my own personal comedian, and the biggest support system until your last day on this earth. This is for you.

To my mom, brother, and family; there is no way that I could have gotten through these last few years without you all. Just having someone to call makes all the difference. Love you guys. Thank you for cheering me on all these years and fully believing in me.

To my committee members, thank you for all the great advice and extra help when I would start to second guess myself.

To my studio family, thanks for being there for me through the thick and thin. It's crazy to think how fast these past five years have gone. I feel as if many of us have grown from friends into family. You guys are great, and I can't wait to see what the future holds for you all.

To my girls Hally, Micah, and Sondi- You have always been there as a shoulder to cry on, and to cheer me on through the highs and lows of this life. Life would not be as good without you girls. Love you, sisters!

PERSONAL INTEREST OF PROJECT:

I have a passion for rural and natural landscapes, which was shaped by growing up on a farm in southwest Missouri. I loved the outdoors and wanted to be everywhere my father was at all times. Since his job was to take care of his land and cattle, he was always outdoors, so I was always outdoors. My father struggled with fragile bones which broke easily, and then he started to having troubles with set bones not healing correctly for over 10 years. This resulted in him having to rely on crutches, and by age 49, he was wheelchair bound. Watching him struggle doing day to day tasks was difficult to witness. After he passed away, I vowed to research ways to make public places more inclusive and accessible in his memory. My father and I shared a mutual love for protected landscapes, so after visiting Yellowstone and Grand Teton National Parks, I recognized a need for universal design to be more fully implemented in the parks. I believe that this topic is important to a growing number of individuals with disabilities.

Figure 1.0: Mammoth Panoramic Picture
(Hahn, 2019)

TABLE OF CONTENTS:

LIST OF FIGURES:

Figure 4.32. Suitability for the site.

CHAPTER 5:

Figure 5.0. Liberty Cap at Hymen Terrace.
Figure 5.1. Universal Design Graphic.
Figure 5.2. Accessibility Categories of Universal Design Guidelines.
5.2.1 United States Access Board. Sept. 2002. “ADAAG - United States Access Board.” Accessed September 4, 2019. https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag#4.1.
5.2.2 Interagency Visitor Use Management Council. 2016. “Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation.” Edition 1. Accessed January 28, 2020.
5.2.3 National Parks Service. 2020. “National Park Service.” Accessed January 20, 2020.
5.2.4 American Society of Landscape Architecture. 2020. “American Society of Landscape Architecture: Home.” Accessed April 2, 2020.
Figure 5.3. Enrichment Categories of Universal Design Guidelines.
5.3.1 Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.
5.3.2 Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]
5.3.3 Interagency Visitor Use Management Council. 2016. “Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation.” Edition 1. Accessed January 28, 2020.
5.3.4 National Park Service (5). 2019. “Denver Service Center (U.S. National Park Service).” Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.
5.3.5 American Society of Landscape Architecture. 2020. “American Society of Landscape Architecture: Home.” Accessed April 2, 2020.
Figure 5.4. Multi-Sensory Categories of Universal Design Guidelines.
5.4.1 Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.
5.4.2 Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]
5.4.3 National Park Service (5). 2019. “Denver Service Center (U.S. National Park Service).” Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.
5.4.4 American Society of Landscape Architecture. 2020. “American Society of Landscape Architecture: Home.” Accessed April 2, 2020.
Figure 5.5. Engagement Categories of Universal Design Guidelines.
5.5.1 Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.
5.5.2 Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]
5.5.3 Interagency Visitor Use Management Council. 2016. “Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation.” Edition 1. Accessed January 28, 2020.
5.5.4 National Park Service (5). 2019. “Denver Service Center (U.S. National Park Service).” Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.
5.5.5 American Society of Landscape Architecture. 2020. “American Society of Landscape Architecture: Home.” Accessed April 2, 2020.
Figure 5.6. Projective Design program and elements from Expanded Universal Design.
Figure 5.7. Primary, Secondary, and Vegetated Zones are

LIST OF TABLES:

Figure 1.0: Photo of Hymen Terrace at Mammoth Hot Springs (Cross 2019)

CHAPTER 1:
Introduction

1. INTRODUCTION | DILEMMA:

The United State Census Data indicates that in 2010, approximately 56.7 million people in the U.S. had a disability (Brault 2010). Specifically, limited mobility, neuro-cognitive impairments, neuro-developmental disorders, low vision, and low hearing are the most common types (Bureau 2014). In 2019, more than 68% of the U.S. population were adults age 26 and older (Brault 2010). It is estimated that by 2030, for the first time in U.S. history, people 65 and older will outnumber those under age 18 (Bureau of Interest Accessibility 2018). Census data reports state, “adults ages 65 and older use a cane, crutches, or a walker at about five times the rate of adults between 18 and 64 years, and they used a wheelchair about four times as often” (Bureau 2014). Also, it is shown that adults age 65 and older are more susceptible to vision, hearing and neuro-cognitive disorders (Bureau 2014). As the population of older adults continues to rise, it is important to consider accessibly designed environments that can accommodate a fuller range of visitors with diverse abilities and needs.

Universal design is a way to improve the health, wellness and livelihoods of every person, regardless of their abilities (Steinfeld and Maisel 2012). As a practice universal design covers the technical aspects of design, but it also addresses aspects of users' experience (Dillon and Green 2014). Federal acts such as the 1990 American with Disabilities Act (ADA) and 1969 Architectural Barriers Act (ABA) were developed to establish technical standards for elements in the built environment, including ramps, parking lots, doors, elevators, restrooms, signage, etc. (United States Access Board 2018). Other documents have since been published, which more specifically address benefits to the human population as a whole, including the Accessibility Standards for Federal Outdoor Developed Areas, ASLA's Universal Design Guide, The 7 Principles of Universal Design, and Interpretive Media Guide. The issue with all these documents is that though each contains information pertinent to universal design practice, when separated from the rest, each document is not comprehensive in terms of all aspects of universal design. In other words, there is not a sole document that comprehensively covers both the technical and experiential aspects of universal design.

In the National Park system, park managers are starting to incorporate some aspects of universal design to improve experiences and amenities within the parks. Yet there are many challenges to overcome before the parks can be truly inclusive. In Yellowstone, one of the most visited National Parks, there are several popular tourist areas that have accessible routes, including Mammoth Hot Springs. However, these areas lack the necessary elements to fully create an equal experience for all visitors, regardless of abilities.

1.1 RESEARCH QUESTION:

How can expanded universal design guidelines be developed and applied to the Mammoth Hot Springs tourist site in Yellowstone National Park to create a more inclusive and immersive experience for visitors with disabilities?

1.2 KEY GLOSSARY:

- Universal Design: a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation (Steinfeld and Maisel 2012). This design strategy creates one design solution for every person no matter what their limits are, to create an inclusive environment (Steinfeld and Maisel 2012).
- Inclusive Design: term that originated in the United Kingdom that is used with the same meaning as universal design. The word "inclusive" was used to show that all people with different types of disabilities are affected in a positive manner with this form of design (Steinfeld and Maisel 2012).
- Immersive Design: the act of designing a place that you are enveloped or entranced into, which creates a getaway experience from your day to day life.
- Disability: Any person who has a physical or mental impairment that substantially limits one of more major life activities (ADA National Network 2019).

1.3 WORK AND DESIGN PROCESS:

The overall goal of this project and report is to develop a comprehensive set of universal design guidelines and apply them in creating a projective design for the Mammoth Hot Springs site in Yellowstone National Park. The purpose of this effort is to show how the experience of visitors, particularly those with wide-ranging disabilities, can be enriched and expanded. This design will go beyond standard accessibility issues and provisions, which are already being addressed by the *Accessibility Guide to Yellowstone* (NPS 2017).

1) Reviewing and comparing various federal acts and guidelines that touch on universal design aspects

2) Researching and documenting applicable design precedents that include components of universal design

3) Interviewing National Park Service staff and subject matter experts to better understand their perspective on opportunities/constraints for implementing universal design in National Parks

4) Conducting a site inventory and analysis of the Mammoth Hot Springs site in Yellowstone

5) Developing a projective design that incorporates aspects of universal design to enrich and expand visitor experience at Mammoth Hot Springs

1.4 GOALS AND ANTICIPATED OUTCOMES:

Universal design principles and guidelines seek to broaden design to better accommodate people with wide-ranging disabilities extending beyond just mobility issues. This project and report focus on three main goals. **First,** the hope is to give a better understanding and to inform readers about the lack of accessibility and inclusive design in the public realm (specifically National Parks) by creating a comparative analysis of existing acts and guidelines. **Second,** create a newly expanded set of guidelines that can be followed for future projects. **Third**, develop a projective design for Mammoth Hot Springs in Yellowstone to showcase the need and possibilities for universally designed spaces.

Figure 1.1: Project diagram to show overall goal, objectives used, and outcomes from objectives (Cross 2019)

Figure 2.0: Minerva Terrace at Mammoth Hot Springs
(Cross, 2019)

CHAPTER 2:
Background

2. BACKGROUND:

The focus of this chapter is to provide relevant information referenced from multiple books, articles, and federal agency documents that together create a foundation for this project and report. The background will cover the following topics:

- Statistics of Disabilities in the U.S.

- Types of Disabilities
- Limited Mobility
- Neuro-Cognitive Disorders
- Neuro-Developmental Impairments
- Vision Impairments
- Auditory Impairments
- Designing for the senses

- History of the Disability Rights Movement

- Design Guidelines
- American Society of Landscape Architecture (ASLA) Universal Design Guidelines
- The Principles of Universal Design by National Institute on Disability and Rehabilitation Research
- Americans with Disability Act (ADA)
- Architectural Barriers Act (ABA)
- Accessibility Standards for Federal Outdoor Developed Areas
- Visitor Use Management Framework- A Guide to Providing Sustainable Outdoor Recreation

- National Parks Service (NPS) History
- Yellowstone's Response to Disabilities

2.1 LITERATURE MAP:

The literature map (Figure 2.1) depicts the primary and secondary topics that were reviewed, and how they interrelate.

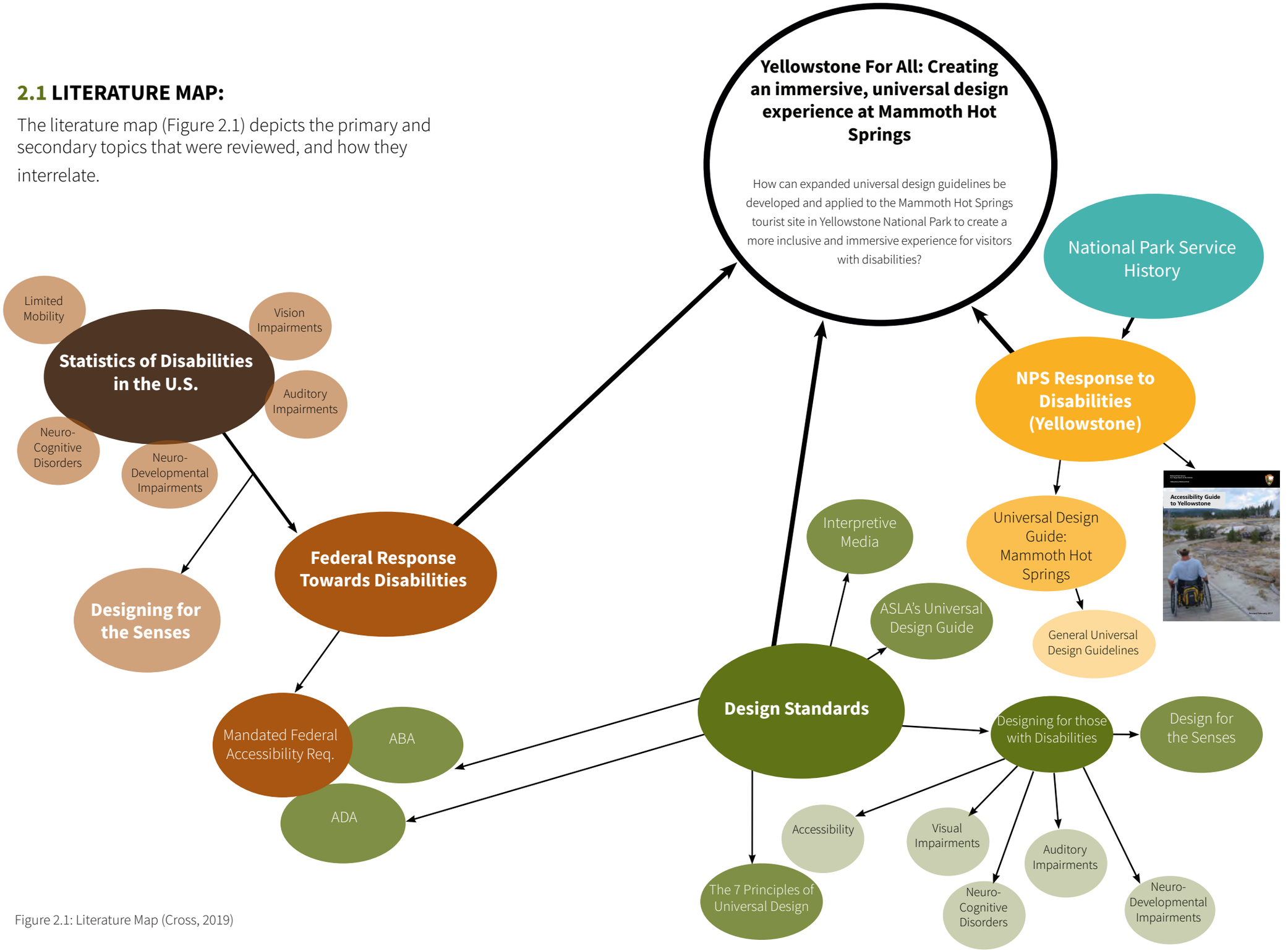


Figure 2.1: Literature Map (Cross, 2019)

2.2 STATISTICS OF DISABILITIES IN THE UNITED STATES:

These statistics cover auditory disabilities, visual disabilities, neuro-cognitive disorders, neurodevelopmental disorders, and those who experience limited mobility.

- In 2014, approximately 85.3 million or 27.2% people living in the U.S. have a disability (Taylor 2018).
- The U.S. census data says that "1.2 million people aged 65 and older lived in nursing facilities and 96.7 percent of them had a disability" (Taylor 2018).
- 5.1% of people aged 18 and older (12.3 million) had difficulty seeing with 1.6 million people recorded of being fully blind (Taylor 2018).
- 7.1% or 17.1 million people were recorded to experience serious hearing difficulty, with 3.4 million being completely deaf (Taylor 2018).
- It is recorded that 7.7% or 18.4 million people used a cane, crutches, or a walker to assist with their physical mobility (Taylor 2018).
- 5.5 million people were recorded to fully use a wheelchair (Taylor 2018).
- In 2014, 23.2 million or 9.7% of people had limited mental or cognitive functioning (Taylor 2018).
- Alzheimer's disease, senility, or dementia was recorded at 3.3% or 7.9 million people (Taylor 2018).
- Autism Speaks states that in 2018 "the CDC determined that approximately 1 in 59 children are diagnosed with an autism spectrum disorder (ASD)," (Austim Speaks, 2019)

2.3 TYPES OF DISABILITIES:

Many people with disabilities struggle to experience outdoor spaces due to a lack of appropriate inclusivity in the public realm. Five main disabilities of concern include: limited mobility, neuro-cognitive disorders, neuro-developmental impairments, hearing loss and low vision. In the following sub-sections, each listed disability will be further explained and information will be given on how to successfully design for each disability type.

DISABILITY TYPES		
LIMITED MOBILITY	Wheelchair Accessibility	Crutch and Cane Use
NEURO-COGNITIVE	Dementia	Alzheimers
NEURO-DEVELOPMENT	Autism	
AUDITORY IMPAIRMENTS	Low Hearing Abilities	Deaf
VISION IMPAIRMENTS	Low Vision	Blind

Table 2.0: Most Common Disability Types (Cross, 2019)

2.3.1 LIMITED MOBILITY:

Limited mobility is a broad term that includes many types of limitations, such as cerebral palsy, spina bifida, and muscular dystrophy (Winterbottom and Wagenfeld 2015). U.S. Census Data from 2014 indicated that 7.7% of the population, or 18.4 million people used a cane, crutches, or a walker to assist with their physical mobility (Taylor 2018). Without appropriate accessibility, those with disabilities may struggle to experience outdoor spaces. In *Designing for the Disabled*, Goldsmith writes, "People are not disabled by the functional limitations of their impairments but by the external barriers that prevent their full participation in the societies where they live" (Goldsmith 1997).

Implications for Design: create opportunities for those with limited mobility to experience spaces in an equal manner as those with complete mobility (Dillon and Green 2019).

- Width of pathways, trails, etc. (at least 3 feet for one way traffic)
- Create wide enough paths to accommodate user's with other paces
- Eliminate barriers such as stairs, narrow sidewalks, and improper arrangements of site furniture
- Slope percentage of pathways (5% or less)
- Adequate hand/guard rails (34-38 inches tall)
- Accessible restrooms (at least 3 foot wide door entry ways, accessible movement inside restrooms)
- Material quality of said pathways, trails, etc. (firm, easy materials to walk on)

2.3.2 NEURO-COGNITIVE DISORDERS:

Neuro-cognitive disorders are defined as decreased mental function due to a medical disease, like dementia (Medline Plus 2019). There are many forms of dementia, which manifests in a variety of ways. The most well-known form of dementia is Alzheimers (Dillon and Green 2019). It is characterized by the degeneration and loss of nerve cells in the brain that are associated with memory, learning, and judgment (Marcus and Sachs). Globally, 44 million people suffer from this disease (Dillon and Green 2019). With the global population rising, there is a probability that Alzheimer's rates will also rise (Dillon and Green 2019).

Individuals with dementia may experience memory loss that disrupts daily life; challenges in planning or solving problems; difficulty completing familiar tasks at home; at or at leisure, confusion with time or place; trouble understanding visual images and spatial relationships; new problems with words in speaking or writing; misplacing things and losing the ability to retrace steps; poor judgment; withdrawal from work or social activities; and, changes in mood and personality (Alzheimer's Association 2020).

Implications for Design:
When individuals are impacted by a neurocognitive disorder, their ability to navigate through public spaces changes dramatically (Dillon and Green 2019). Clare Cooper Marcus suggests guidelines when working with those with neuro-cognitive disorders in *Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces*. These include involving management in the design process who are knowledgeable about the disease, creating clear and visible entry ways into and out of proposed facilities, ensuring all elements in the garden are visible, gardens designed in a way that full sunlight comes in during the morning when patients use it, incorporating shade in the site because those who have dementia tend to not know if they are hot and cold, and creating an enclosed space on each side of the garden which will create a more secure environment (Marcus and Sachs, 2014).

2.3.3 NEURO-DEVELOPMENTAL IMPAIRMENTS:

Neuro-developmental impairments are defined as "disabilities associated primarily with the functioning of the neurological system and brain" (EPA 2015). Autism: Autism is one of the more common neuro-developmental impairments (Dillon and Green 2019). Nearly 1% or 70 million people in the world are autistic (Dillon and Green 2019). Those with autism experience life in a different way than most. They have the "capacity for detailed thinking, expansive long-term thinking and examining complex patterns but have problems understanding social nuances, filtering stimuli, and planning daily living" (Green 2015).

Implications for Design:
When designing for those with autism, designers should "create transparency through spatial sequences and smooth transitions between uses" (Green 2015). Designed environments should enable individuals to feel safe and provide a place where they can engage with their surroundings (Green 2015). Also, it is important to create spaces that are quiet, off the beaten track, and well lit (Green 2015). Finally, a design for those with autism should give users the opportunity to interact with elements, such as interactive signage Dillon and Green 2019).

2.3.4 AUDITORY IMPAIRMENTS:

Low Hearing Abilities: Low Hearing impairments are very common in the United States. The 7.1% or 17.1 million people were recorded to experience serious hearing difficulty, with 3.4 million being completely deaf (Taylor 2018). Although the level of hearing impairments varies, it is suggested that spaces are designed for those who have complete hearing loss (Lupton and Lipps 2018).

Deaf: Complete hearing loss can make it more difficult for individuals to experience designed environments without appropriate considerations for their needs. Deafspace is a type of design strategy that "thrives through full access to communication and the unique cognitive, cultural and creative dimensions of the Deaf experience" (Lupton and Lipps 2018). DeafSpace begins to address the major need for a better built environment for those who are hearing impaired are able to enjoy (Vaughn n.d.). To make sure that deaf individuals feel most secure in their surrounding environment, there are five sensory design principles that are applied to every DeafSpace.

1) Peripheral view is the use of rhythmic, repetitive, and intuitive visual cues to allow a deaf person's peripheral vision to work more effectively in orientation (Lupton and Lipps 2018).

2) Transparency is used to create a degree of enclosure but is also important for creating a safe atmosphere (Lupton and Lipps 2018).

3) Reflective surfaces can help deaf individuals to see behind them and around corners, so that they are able to monitor their environment (Lupton and Lipps 2018).

4) The ability to feel different vibrations in the ground surface helps to becomes a wayfinding tool for those who are deaf (Lupton and Lipps 2018).

5) Shared sensory reach is important because it allows people to know what to expect is in front of them or coming up behind them (Lupton and Lipps 2018).

Implications for Design:
When designing for a public space with the deaf population and those with hearing impairments in mind, the following list of elements may incorporate (Vaughn n.d.):

- Provide a transitional zone between sidewalk, planting area, and the street (different materiality).

- Create a buffer zone between the sidewalk and the street.
- Integrate lighting for safer conditions during the evening hours.
- Use of movable seating for different sized groups.
- Minimum of 10 feet to create opportunity for conversation along walkway.
- Create an organization through materiality choices throughout space.
- Use of visual signage for crosswalks, events, transportation, and attractions.

2.3.5 VISION IMPAIRMENTS:

285 million people worldwide struggle with some type of vision Impairment, and for 80 million of this population, the vision impairment is permanent (National Institute of Building Sciences 2019). Because low vision affects many people, the National Institute of Building Sciences created a set of guidelines to follow for those with experiencing a form of low vision (National Institute of Building Sciences 2019).

Implications for Design: The *National Institute of Building Sciences* provides the following guidance when designing for those with low vision (2019).

- Ensure viability and eliminate any obstacles
- Wide pathways to allow complete circulation to the user throughout the entire space
- Pavement material should have a medium hue that is different than the color of the stairs, so the user is able to tell a distinction between the two
- Tree branches should be out of the user's way, to not present an obstacle.
- If design has movable seating, make sure that the seating stays in a specific location and is a brighter color than the surrounding materials.

2.3.6 DESIGNING FOR THE SENSES:

"Sensory design considers not just the shape of things but how things shape us-our behavior, our emotions our truth" (Lupton and Lipps 2018). It is important to know how to design considering all senses so that people can more fully interact with their surrounding environment. In the past, designers would create fixed elements, but now there is a push to how people will interact with the space over time. Sensory design makes us more human because it is accepting of all people and meets them where they are, depending on their physical or mental limitations (Lupton and Lipps 2018). When we experience a place for the first time, a good design usually encompasses all the senses: Sight, Hearing, Taste, Smell and Touch. The following components can be added to a design to incorporate the senses (Lupton and Lipps 2018 Creek 2017).

- **Smell:** the addition of vegetation with good odor
- **Sight:** use of bright colors such as yellow, orange and some blues and purples
- **Taste:** vegetation incorporated into the design that is edible (fruits and vegetables)
- **Hear:** audio capabilities in interpretive signage, water features
- **Touch:** elements added to signage that you can touch, braille, gaming elements such as giant Jenga.

2.4 HISTORY OF THE DISABILITY RIGHTS MOVEMENT:

1932: Franklin Delano Roosevelt elected as 32nd President of the United States: Roosevelt and wife, Eleanor Roosevelt were big activists in organizing a voice for those who had a

disability, due to Franklin Roosevelt's diagnosis with Polio in 1921 (Fletcher, Agnes, and Nick O'Brien 2008).

1935: The League of the Physically Handicapped organized in New York City, NY in response to fight for equal employment for those with disabilities. This group was founded with only 6 people but grew to have a several hundred people. This group brought light and more importance to disabilities that were not seriously addressed prior (Fletcher, Agnes, and Nick O'Brien 2008).

1935: The Social Security Act established: benefits for "victims of industrial accidents, unemployment insurance, aid for dependent mothers and children, the blind, and physically handicapped" (Social Security Act N.D.).

1937: The March of Dimes is founded: Franklin D. Roosevelt founded nonprofit organization with main purpose to combat polio (later expanded focus to prevent birth defects and infant mortality. (March of Dimes 2019)

1940: Jacobus ten Broek organizes National Federation of the Blind. This organization strives to accommodate and give back to the blind and educate people about this issue (National Federation of the Blind 2019)

1947: Paralyzed Veterans of America organized: offers support to veterans and families for employment services, benefits, and more (Paralyzed Veterans of America 2019).

1960: Social Security Disability Insurance (Fletcher, Agnes, and Nick O'Brien 2008)

1961: The American Council of the Blind (Fletcher, Agnes, and Nick O'Brien 2008). This council formed to "increase the independence, security, equality of opportunity, and quality of life for all blind and visually impaired people" (American Council of the Blind 2019).

1964: The Civil Rights Act: "prohibited discrimination in public places, provided for the integration of schools and other public facilities, and made employment discrimination illegal" (Civil Rights Act N.D.).

1968: Architectural Barriers Act becomes law: requires "buildings or facilities that were designed, built, or altered with federal dollars or leased by federal agencies after August 12, 1968 to be accessible (United States Access Board 2018). This act pertains to all federal agencies including National Monuments, National Parks, federal office buildings, U.S. courthouses, and federal prisons (United States Access Board 2018).

1973: United States Access Board, then known as The Architectural and Transportation Barriers Compliance Board is established under the Rehabilitation Act of 1973 to enforce the Architectural Barriers Act (Fletcher, Agnes, and Nick O'Brien 2008).

1983: ADAPT or American Disabled for Accessible Public Transit is organized: organization that "disability rights activists to engage in nonviolent direct action, including civil disobedience, to assure the civil and human rights of people with disabilities to live in freedom" (ADAPT 2019).

1988: Fair Housing Act amended to include people with disabilities

1988: Civil Rights Restoration Act of 1987 becomes law: "broad scope of coverage and to clarify the application of title IX of the Education Amendments of 1972, section 504 of the Rehabilitation Act of 1973, the Age Discrimination Act of 1975, and title VI of the Civil Rights Act of 1964" (GovTrack 2004).

1990: Americans with Disabilities Act becomes law: signed by President George Bush: "a civil rights law that prohibits

discrimination against individuals with disabilities in all areas of public life, including jobs, schools, transportation, and all public and private places that are open to the general public" (ADA National Network 2019). This law looks at the minimum requirements for "newly designed and constructed or altered State and local government facilities, public accommodations, and commercial facilities" (Department of Justice 2010).

2008: The ADA Amendments Act (ADAAA) becomes law: act makes it "easier for an individual seeking protection under the ADA to establish that he or she has a disability within the meaning of the ADA" (U.S. Equal Employment Opportunity Commission N.D.).

2014: Accessibility Standards for Federal Outdoor Developed Areas: Published article looking specifically at trail heads, camp ground facilities, and other facilities (United States Access Board 2018).

2017: Programmatic Accessibility Guidelines for National Park Service Interpretive Media: Guidelines that help to give broad overview of signage for all people to be able to read (Harpers Ferry Center Accessibility Committee 2017).

2019: American Society of Landscape Architecture (ASLA) Universal Design Guide published (Dillon and Green 2019).

2.5 SPECIFIC DESIGN GUIDELINES AND ACTS:

2.5.1 AMERICAN SOCIETY OF LANDSCAPE ARCHITECTURE (ASLA) UNIVERSAL DESIGN GUIDE:

ASLA's "Universal Design Guide" establishes the importance of designing for everyone. The guide stresses to design place by thinking about the user first. "Everyone navigates the built environment differently, with abilities changing across a person's lifespan" (Dillon and Green 2019). This guideline applies principles intended to create more inclusive spaces for "people with physical, auditory or visual disabilities, autism or neurodevelopmental and/or intellectual disabilities, or neuro-cognitive disorders" (Dillon and Green 2019). As a designer, it is important to look at more than just the technical requirements of ADA, ABA or the Rehabilitation Act of 1973, and continue to study the experiential quality of the user's visit.

2.5.2 THE 7 PRINCIPLES OF UNIVERSAL DESIGN:

The 7 Principles of Universal Design are found in the "Accessibility and Universal Design Standards" through the Denver Service Center. The Denver Service Center is led by the National Park Service (NPS) "whose mission is to preserve natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations" (Denver Service Center 2019). "The 7 Principles of Universal Design" is a document that examines equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and the size and space for approach and use (Denver Service Center 2019).

2.5.3 PROGRAMMATIC ACCESSIBILITY GUIDELINES FOR NATIONAL PARK SERVICE INTERPRETIVE MEDIA:

Interpretive media guidelines were created to address the issues behind interpretive media in the National Park System and to propose guidelines that may help to manage media problems (Harpers Ferry Center Accessibility Committee 2017). This document is a broad overview

of many issues. It discusses the planning process of this guideline service, scope, audiovisual guidelines for those with different types of disabilities with specific numbers to follow, exhibit design for the different disabilities, lighting, and signage (Harpers Ferry Center Accessibility Committee 2017). While this document begins to address ways to design for interpretive media, cumbersome and specific information is difficult to find.

2.5.4 VISITOR USE MANAGEMENT FRAMEWORK- A GUIDE TO PROVIDING SUSTAINABLE OUTDOOR RECREATION:

The National Park Service (NPS) has continued to take pride in protecting and preserving their land. In fact, in the NPS mission statement their goal is to "preserve unimpaired natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations (NPS 2019)." Since its founding, the NPS has published many documents like the Visitor Use Management Framework (VUM) that provides viable access to way to continue to preserve land in an inclusive way. "The Visitor Use Management Framework is a process designed for federal managers to collaboratively develop, implement, and monitor strategies and actions to provide sustainable access to lands and waters (Interagency Visitor Use Management Council 2016)." The Visitor Use Management Framework was developed to ensure that each agency would apply the same steps when it came to visitor use management (Interagency Visitor Use Management Council 2019). This framework is to be applicable for not only for land management agencies, but also other public spaces at different scales (Interagency Visitor Use Management Council 2019). This framework has four steps for how to assess lands are to build the foundation, 2) define visitor use management direction, 3) identify management strategies, and to 4) implement, monitor, evaluate, and adjust (Interagency Visitor Use Management Council 2016). To build a framework, the VUM "clarifies the project need and develops an action plan (Interagency Visitor Use Management Council 2016)" based on the given information. The VUM defines visitor management direction by first building the foundation for a change in a specific site (Interagency Visitor Use Management Council 2016). Secondly, an analysis is created to see how visitors are using the site. Third, strategies are created to best manage the issue in the site. Lastly, these strategies will be implemented and monitored to see how each site is working to its potential overtime (Interagency Vistor Use Management Council 2016).

Figure 2.2: Visitor Use Management Framework: (Interagency Visitor Use Management Council 2016) Adapted by (Cross, 2019)

2.5.5 AMERICANS WITH DISABILITIES ACT (ADA):

The Americans with Disability Act is a civil rights law that was passed by Congress and signed by George H.W. Bush in 1990 (Gostin 2015). This law gives the disabled a stronger voice and creates a "move towards a more inclusive society, not only to help remove discrimination, which is clearly of paramount importance, but also to allow disabled people the opportunity to make a valuable contribution to society and to the economy" (Fletcher and O'Brien 2008). In 2008, the ADA Amendments Act furthered the value of the Americans with Disabilities Act, to help those with disabilities to be more fully heard. Although ADA and accompanying provisions have been beneficial to creating a greater voice to the issue of accessibility, this Act's strength is geared towards the technical aspects of design

and not the full user experience (Dillon and Green 2019). ADA Standards are not required to be followed in National Parks unless state, local governments, and private entities use the provisions for their own guidance of trail, facilities, and viewing areas/attractions (United States Access Board 2014).

2.5.6 ARCHITECTURAL BARRIERS ACT (ABA):

"ABA requires access to facilities designed, built or altered with Federal dollars or leased by Federal agencies," (National Park Service July 2019) with national parks included under this law. This law states "where access is required and provides detailed specifications for ramps, parking, doors, elevators, restrooms, assistive listening systems, fire alarms, signs, and other accessible building elements" (United States Access Board 2018). This federal law was established in 1968 and was one of the first federal laws to break the physical barriers of existing buildings and their facilities (United States Access Board 2018). The ABA Standards are the main federal law followed by national parks (United States Access Board 2018). ADA Standards are not followed in National Parks unless state, local governments, and private entities use the provisions for their own guidance of trail, facilities, and viewing areas/attractions (United States Access Board 2014).

2.5.7 ACCESSIBILITY STANDARDS FOR FEDERAL OUTDOOR DEVELOPED AREAS:

In 2014, the United States Access Board published *Accessibility Standards for Federal Outdoor Developed Areas* (United States Access Board 2014). This document was published to give designers, owners and operators guidance for how ABA standards apply to trails, picnic and camping facilities, viewing areas, and beach access routes (United States Access Board 2014). This guide is specific for National Parks, but can be used by any federal agency (the same as ABA) (United States Access Board 2014). This guide does not follow ADA regulations, but designers, and owner/operators are encouraged to also look to those accessibility standards and requirements (United States Access Board 2014).

2.6 NATIONAL PARKS SERVICE (NPS) HISTORY:

The National Parks Service is an agency of U.S. Department of Interior, which manages/maintains national parks, national monuments and many other historical sites (Pletcher n.d.). The National Parks Service came into existence as only due to the U.S. expanding its borders westward. Expeditions like the Lewis and Clark Expedition and Ferdinand Hayden's Expedition with William Jackson and Thomas Moran, helped to document the West's uncharted landscapes. The paintings and photographs that were taken on Hayden's expedition to Yellowstone helped to make it America's first national park in 1872 (Pletcher n.d.). Following this, Yosemite (1890), Crater Lake (1902), and Glacier (1910) were designated as national parks (Pletcher n.d.). In 1916, through the efforts of Stephan Mather and assistant Horace Albright, the "Organic Act" was passed and later became the National Park Service (Pletcher n.d.). The National Park Service was officially signed in 1916 by U.S. President Woodrow Wilson to "conserve the scenery and the natural and historic objects and wildlife to leave them unimpaired for the enjoyment of future generations" (Pletcher n.d.). To this day, National Parks allow people to escape the hustle and bustle of urban life, and provide peace, restoration and recreation within places that are dedicated to the preservation of natural systems.

2.7 RESPONSE TOWARDS ACCESSIBILITY IN YELLOWSTONE AND GRAND TETON NATIONAL PARKS:

“National parks belong to all Americans, and the National Park Service will welcome all Americans to experience their parks” (National Park Service: Department of the Interior 2014). In 2015 the National Parks Service published, “All In! Accessibility in the National Park Service” to address the issue that many facilities and programs within the NPS have barriers that restrict visitors with disabilities from opportunity to enjoy (National Park Service: Department of the Interior 2014). This publication enforces the use of the Architectural Barriers Act or ABA. The Architectural Barriers Act (ABA) requires that “physical access to facilities designed, built or altered with Federal dollars or leased by Federal agencies” be provided for those with limited mobility needs (National Park Service, August 2019). The NPS is subject to ABA. The ABA mandates that “detailed specifications for ramps, parking, doors, elevators, restrooms, assistive listening systems, fire alarms, signs, and other accessible building elements should be provided” (United States Access Board 2018). The United States Access Board published a document in 2014 that more closely details accessibility of camping facilities, trailheads, and other facilities (United States Access Board 2014). Areas within National Parks are not required by law to follow Americans with Disabilities Act, but many state governments, local governments, and private entities follow the guidelines when designing facilities, trailheads, and attraction/viewing areas in the Parks (United States Access Board 2014). Although ADA is often used, the standards only “focus on technical aspects of accessibility over experiential quality” (Dillon and Green 2019).

Park advisors in Yellowstone National Park continue to make strides to create a more accessible park. Yellowstone National Park published “Accessibility Guide to Yellowstone” which highlights Canyon Village, Grant Village, Lake Village-Fishing Bridge-Bridge Bay, Madison, Mammoth Hot Springs, Norris, Old Faithful, and West Thumb. This package highlights each attraction and proposes strategies to eliminate barriers and create easier access. The guide also states that Yellowstone has hired sign language interpreters, created larger print or braille versions of park maps, and continues to implement wheelchair accessibility for each attraction through the use of *ABA* standards and *Accessibility Standards for Federal Outdoor Developed Areas* (National Park Service: Department of the Interior August 2014).

The Grand Teton National Park has also started to assess its physical barriers and limited access throughout the park. In the park “paths are mostly paved with gentle slopes, accessible parking is available near facilities and activity zones, and facilities are relatively new, open-concept, and easy to navigate. However, there remain barriers to accessibility at every park area that was assessed, some obstacles that would only inconvenience a person with a disability and others that would severely limit their ability to see and participate in activities” (Grand Teton National Park 2019). Grand Teton National Park is making strides towards creating a more inclusive design for all people to enjoy. Throughout the park there are some locations, such as Jenny Lake, Craig Thomas Discovery and Visitor Center, and the Laurance S. Rockefeller Preserve which have multi-media exhibits that create “additional programmatic options which enhance all park areas for visitors, particularly those with cognitive disabilities, blindness, deafness or vision loss” (Grand Teton National Park 2019). Despite the multi-media options, the park’s signage still lacks braille, larger print, and audio or electric formats (Grand Teton National Park 2019).

Figure 3.0: Close up of terrace formations in the Minerva Terrace.
(Hahn, 2019)

CHAPTER 3:
Methodology

3. METHODOLOGY:

The project's methodology will **inform** readers on the lack of accessibility and inclusive design in the public realm (specifically National Parks); **evaluate** published research to help generate **newly expanded universal design guidelines** that can be applied to future site planning and design projects; to develop a **projective design** for Mammoth Hot Springs in Yellowstone National Park. This project utilizes a projective design methodology. Specific research methods include: comparative analysis, interviews, precedent studies, and a site inventory and analysis.

3.1 COMPARATIVE ANALYSIS OF EXISTING GUIDELINES:

The documents chosen for the comparative analysis included federal acts and notable professional publications. To be selected, a document needed to include information on at least three of following universal design components: path widths, slope % of trails or pathways, materiality used in the design, light introduced in design, designing for those with different disability types, signage (wayfinding and educational), exhibit design, and the overall experience. This list of components was referenced from ASLA's Universal Design Guide and were reiterated by research on the 5 disibility types addressed in Chapter 2. The Architectural Barriers Act (ABA) and Americans with Disabilities Act (ADA) focus more on the technical aspects of design. The 7 Principles of Universal Design, ASLA Universal Design Guide, Programmatic Accessibility Guidelines: Interpretive Media, and the Visitor Use Management (VUM) also highlight the technical aspects of design, but focus more on user experience. The blue dots in Figure 3.2 indicate where each document addresses a specific universal design component.

Through the analysis it became evident that there is not a single published act or set of guidelines that comprehensively addresses each of the universal design components. Key aspects from each of the acts and guidelines will be combined to create the Expanded Universal Design Guidelines presented in Chapter 5.

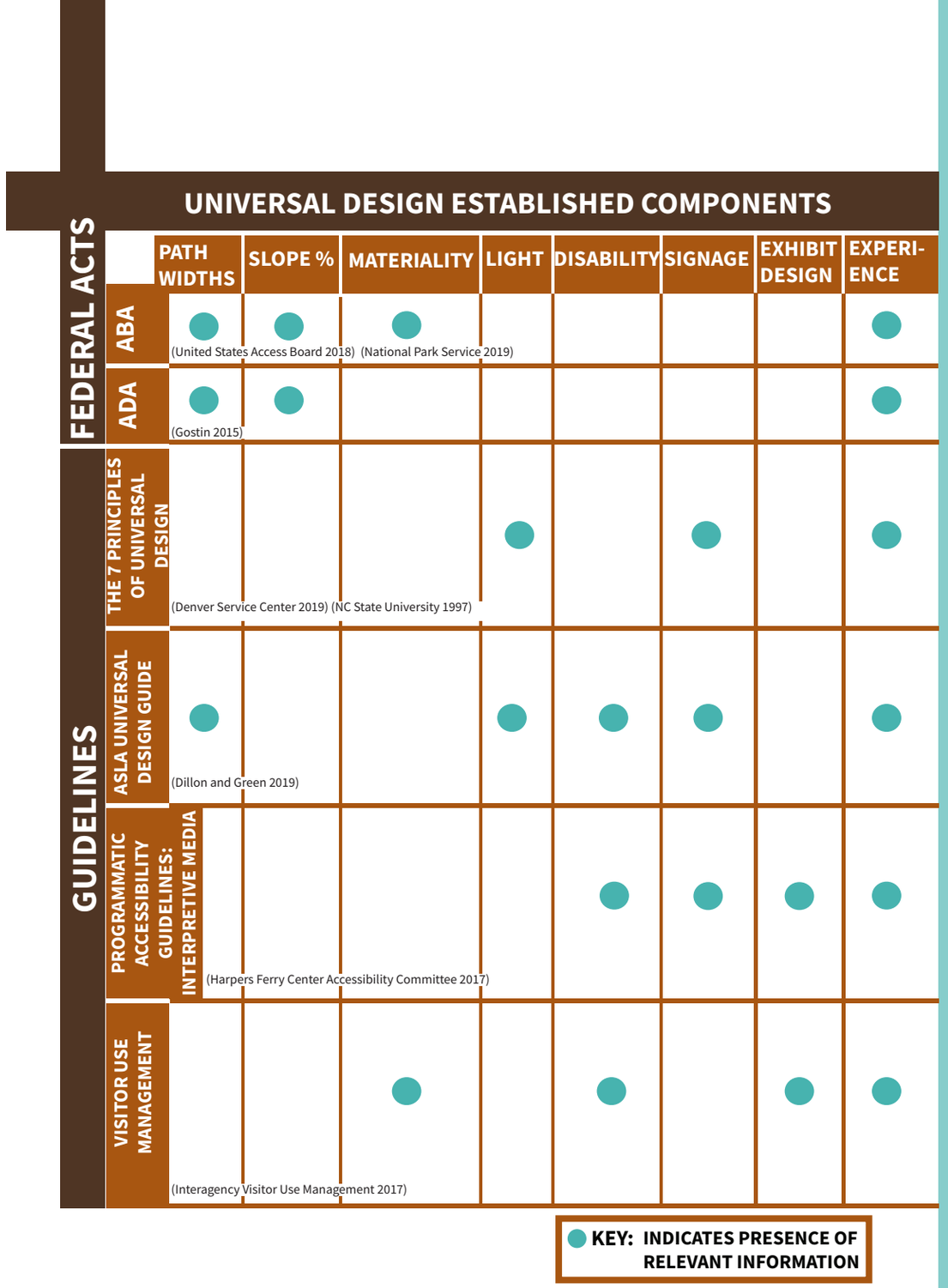


Figure 3.1: Comparative Analysis (Cross, 2020)

3.2 PRECEDENT STUDIES:

Universal Design is a relatively new topic, that has not been fully addressed in National Parks. Even though several National Parks addressed accessibility, it is a more technical approach, guided by ADA and ABA, than experiential design(Dillon and Green 2019).

A precedent study is defined as “an earlier event or action that is regarded as an example or guide to be considered in subsequent similar circumstances” (LEXICO 2019). By examining built projects that use universal design practices, examples of specific design components are learned. These findings help to inspire and inform the projective site design.

Each of the selected precedents vary in context, scale, scope, and application of universal design components. However, each precedent has the following aspects in common:

- Accessible paths for all people to use.
- Design for all seasons
- Designs are not restricted to a geological region so that some of these findings could transfer to other National Parks
- Each site is open to the public
- Designs are not restricted on size because findings could transfer to other National Parks
- Each site preserves nature in its specific context (both urban and rural)

The precedents that were studied are the Track-Chair Program at Staunton State Park, Grand Teton’s Jenny Lake, Story Mill Park, and Jasper National Park’s Columbia Icefield Skywalk, Tongva Park and Ken Genser Square, Woolwich Squares, McIntire Botanical Garden, and Demonstration Gardens in the Chicago Botanic Garden.

To standardize the presentation of findings, the following structure was used:

- Name
- Location
- Designer
- Design approach
- Universal Design Strategies Used
- Strategies for Projective Design

Full findings from the precedent studies are discussed in Chapter 4, however a preliminary description of each project is presented on subsequent pages.

3.2.1 STAUNTON STATE PARK: TRACK-CHAIR PROGRAM:

Staunton State Park is located in Pine, Colorado and opened in May 2013. This park offers something for everyone, including a pet area, bike trails, opportunities for accessible fishing, and a track-chair program. The track-chair program allows for those who experience limited mobility, an opportunity to enjoy three of the trails found in Staunton. Davis Ponds Trail is 2.7 mile loop trail that takes the user along a beautiful path that leads to Davis fishing ponds where there is an accessible fishing pier and restroom ("Colorado Parks & Wildlife - Staunton" n.d.). Mason Creek is a 2.4 mile trail through open meadows and forest lands with views of Mason Creek ("Colorado Parks & Wildlife - Staunton" n.d.). Lastly, Staunton Ranch Trail is a 3.8 mile trail that showcases views of Lions Head and Pikes Peak ("Colorado Parks & Wildlife - Staunton" n.d.).

3.2.2 GRAND TETON NATIONAL PARK: JENNY LAKE:

Jenny Lake is a must-see in Grand Teton National Park. Over the years, Jenny Lake has suffered major degradation because there was no clear way to get to the lake front. To address this issue, recently Hershberger Design has partnered with the National Park Service Staff, Grand Teton National Park Foundation, and the Sibbett Group to redesign the user's experience surrounding Jenny Lake. The design strives to "improve safety, accessibility, and educational opportunities while bringing front country areas into compliance with the Architectural Barriers Act Accessibility Standards" ("Hershberger Design." n.d.). In doing so, they have redesigned plazas, trails, backcountry trails, and interpretive spaces ("Hershberger Design." n.d.).

3.2.3 STORY MILL PARK:

Located in Bozeman Montana, Story Mill 60 acre community park that has many features including picnic pavilions, accessible playgrounds, beautiful overlooks, an amphitheater, and community gardens (Bozeman MT n.d.). This park was designed to restore rivers and the wildlife surrounding the park, while creating new amenities (The Trust for Public Land 2018). The new amenities are designed so that all people can enjoy and appreciate them in their own way.

3.2.4 COLUMBIA ICEFIELD SKYWALK:

Glacier Skywalk is located in Jasper National Park in Jasper, AB, Canada. The skywalk was opened on May 1, 2019. It includes a glass-floored lookout which features "waterfalls, wildlife, fossils and more" ("Columbia Icefield Skywalk: Cliff-Edge Glass Walkway in Jasper National Park" n.d.). This attraction is especially interesting because of its design. The users will leave the skywalk knowing more about the history of the surrounding area thanks to a series of interpretive visual displays.

3.2.5 TONGVA PARK AND KEN GENSER SQUARE:

Tongva Park and Ken Genser Square are located in Santa Monica, California. What once was a parking lot is now a popular park and destination for locals and tourists alike. The vision of this park is to "construct a park and garden walk that reflected the identity of the city and created a destination and gathering place of great social, ecological and symbolic value (American Society of Landscape Architects, 2018)." Tongva Park and Ken Genser Square bring sustainability, ecology, and social vibrancy to this area of the city.

3.2.6 WOOLWICH SQUARES:

In 2012, Woolwich Squares opened in London, England. The goal of this design was to create a fully accessible public space for the Borough of Greenwich. Pedestrian

movement was examined around the site to create the site's unique circulation (Gustafson Porter + Bowman, 2019). To help create a bigger gathering space for the users of the site, terracing is used to improve the steepness of the slopes and create more seating options for those in the site (Gustafson Porter + Bowman, 2019). The primary purpose of this space is stage or performance area. Directly behind the performance area is a water feature which acts as a place to cool off and relax during the hot summers (Gustafson Porter + Bowman, 2019).

3.2.7 MCINTIRE BOTANICAL GARDEN- MASTERPLAN FOR RESILIENCY AND HEALING:

Mikyoung Kim Design studio was hired by the McIntire Botanical Garden to redesign a 130 acre portion of McIntire Park to a Botanical Garden in Charlottesville, VA (American Society of Landscape Architects 2019). This new master plan "integrates crucial stormwater management and infrastructural issues (American Society of Landscape Architects 2019)", ecological concerns, and cultural value to create a very powerful and inclusive design. The goal of this project is to bring the community together and teach the value of stormwater management and how the systems work together (American Society of Landscape Architects 2019).

3.2.8 DEMONSTRATION GARDENS- CHICAGO BOTANIC GARDEN:

Pashek + MTR Firm designed many garden exhibits at Chicago's Botanic Gardens. Their gardens are known for "showcasing barrier-free elements and is used for demonstrations and as a functional event space (Pashek + MTR, 2020)." This series of gardens has raised beds, edible gardening, organic gardening, a kitchen amphitheater, and opportunities to for a multi-sensory experience (Pashek + MTR, 2020). This series of gardens was designed to create opportunities for different types of people.

3.3 INTERVIEWS:

Phone or email interviews were conducted with three subject matter experts who have worked closely with the National Park System and inclusive design. Three individuals were chosen to be interviewed because they all had work experience related to universal design. At Yellowstone National Park, the Landscape Architect and Accessibility Technician, Leigh Dunworth was interviewed. This interview specifically covered the overall success of accessibility throughout the whole park, projects that are implemented in the Park System, and what the specific limitations or problems that is experienced when working with universal design. Next, the Landscape Architect and Accessibility Coordinator of Grand Teton National Park, Jessica Brown was interviewed. This interview's focus was on Grand Teton National Park's steps towards universal design and how the design strategies are effectively implemented. Lastly, Hans Flinch of Hershberger Design was interviewed. This interview helped to give more clarity of how a new design would be built in a National Park setting, how a universally designed site has impacted the visitor's experience, sensory elements that have been incorporated throughout the sites, and what design guidelines were followed.

In Chapter 4: Findings, each interview is summarized. From this data, design decisions regarding the projective design at Mammoth Hot Springs are better informed.

3.4 SITE INVENTORY AND ANALYSIS:

In order to inform the projective site design of Mammoth Hot Springs at Yellowstone National Park, a site inventory and analysis was conducted. Specific data sets and reports were sourced to address the following issues on the site.

- **Yellowstone History and Attractions:** The history of Yellowstone National Park and how all the attractions are connected.
- **Site History:** The history surrounding Mammoth Hot Springs, the importance behind the site, and the geological features throughout Mammoth Hot Springs.
- **Microclimate:** The climate of Mammoth Hot Springs.
- **Site Identity:** The size of the site, views, spring locations and location within the region/Yellowstone National Park.
- **Site Elevation:** Examining the site's elevation through visual/sectional form.
- **Site Inventory/Analysis:** Hymen Terrace: Liberty Cap Inventory through pictures of site
- **Site Inventory/Analysis:** Upper Terrace(s) Inventory through pictures of site
- **Vegetation:** Highlights the existing vegetation of Mammoth Hot Springs.
- **Amenities:** Location of bathrooms, lodging, bus stops, and food location near the site
- **Circulation:** Examining the existing trail system around the site and parking/type of parking around site.
- **Site Opportunities:** Mapping of locations based on appropriate purpose of the element that is being addressed.

3.5 PROJECTIVE DESIGN (MAMMOTH HOT SPRINGS):

A projective design was created to illustrate the application of the expanded universal design guidelines. The site is located at Mammoth Hot Springs in Yellowstone National Park. Mammoth Hot Springs is directly tied to Historic Mammoth Hot Springs, which is where Yellowstone's park headquarters are located.

The Projective Design of Mammoth Hot Springs includes site plans and high-quality renderings to stimulate one's experience. This experience is told through the lens of the 5 disability types: Limited Mobility, Neuro-Cognitive Disorders, Neuro-Developmental Impairments, Hearing Loss, and Low Vision. The complete design is highlighted in Chapter 5.

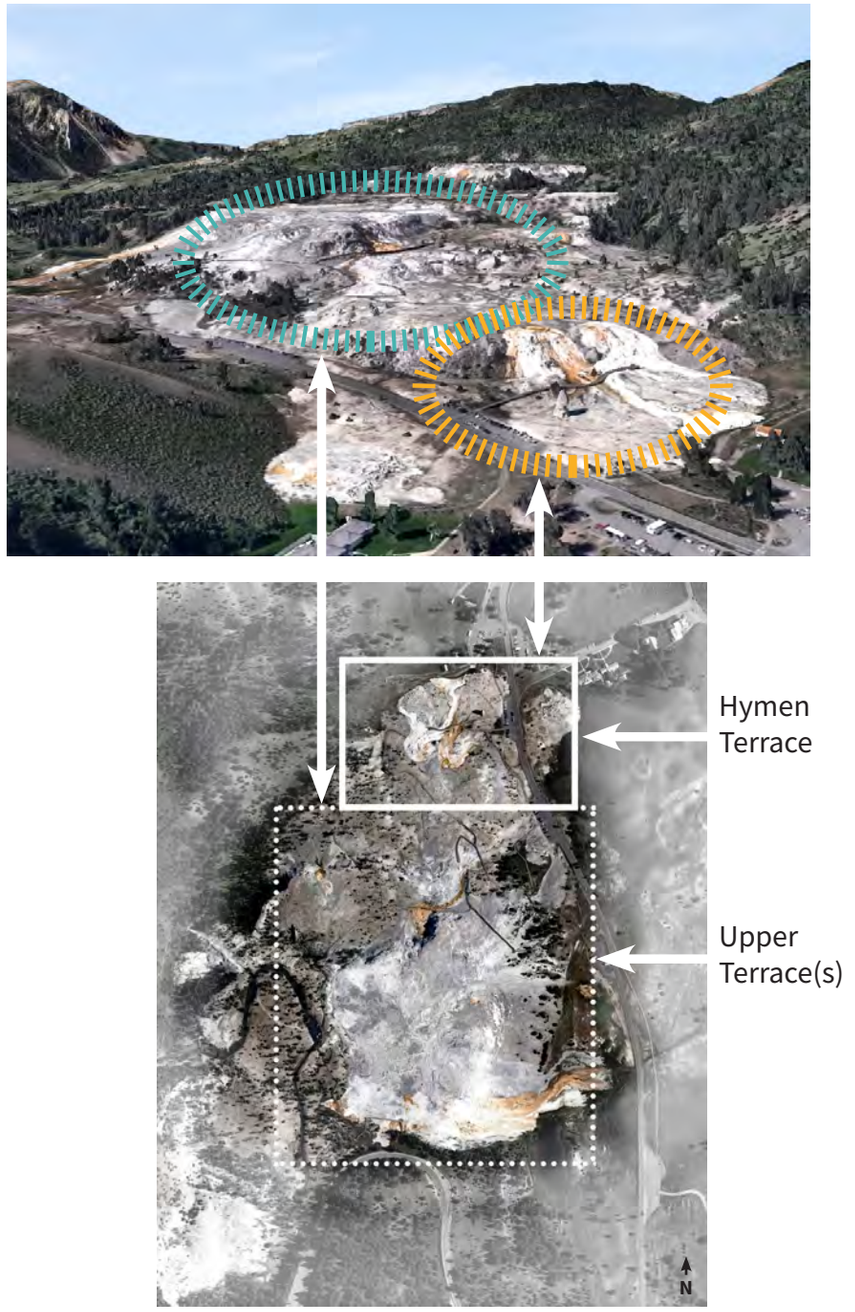
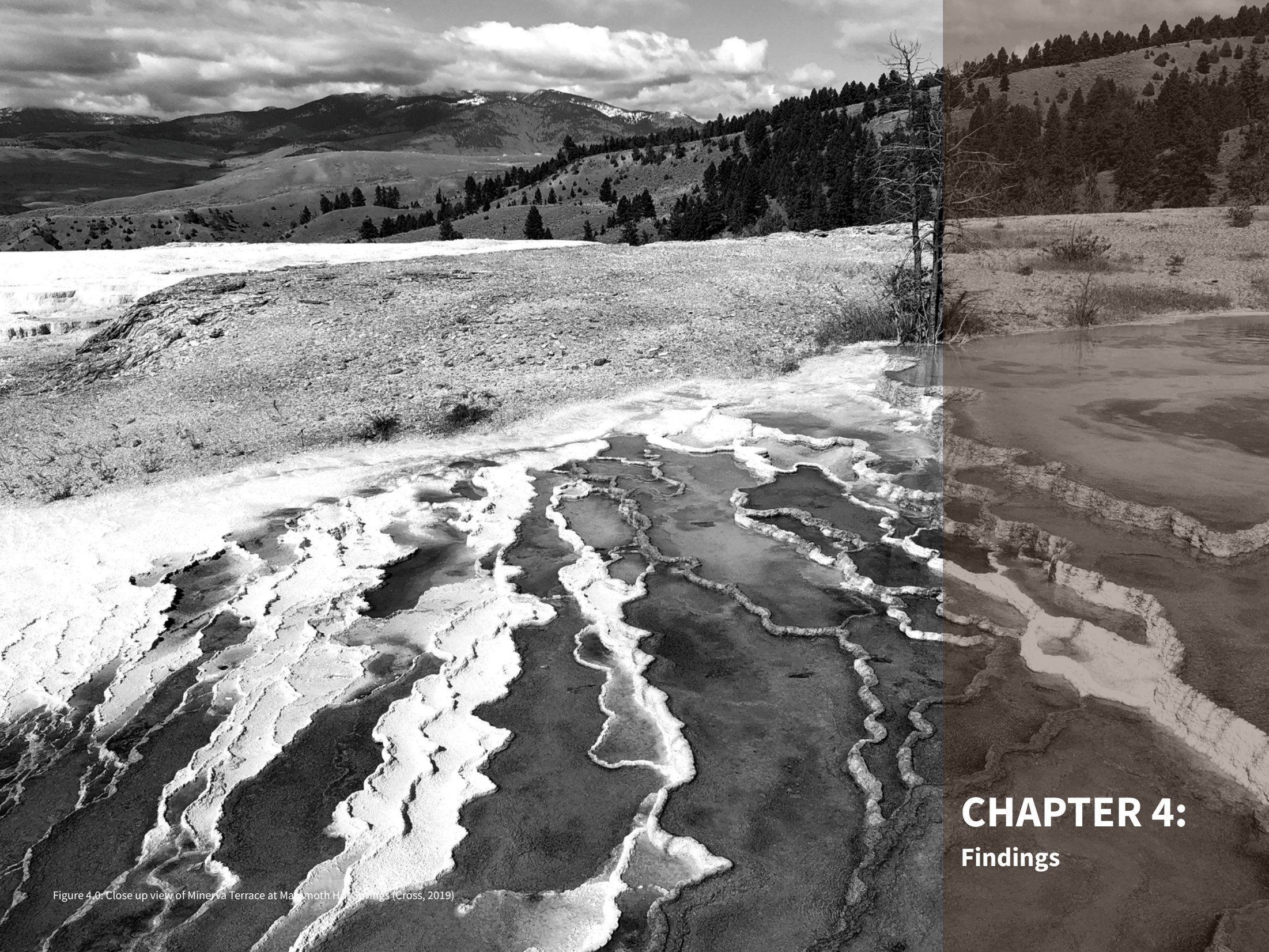


Figure 3.2: Graphic showing site for projective design.
(Cross, 2019)



CHAPTER 4:
Findings

Figure 4.0: Close up view of Minerva Terrace at Mammoth Hot Springs (Cross, 2019)

4. INTRODUCTION:

The following chapter presents findings from the comparative analysis, interviews, precedent studies, and site inventory and analysis.

4.1 PRECEDENT STUDY SUMMARY:

This section looks at eight different precedents that meet the following criteria explained in Chapter 3: Methodology. The following will be explained for each precedent:

- Name
- Location
- Designer
- Design approach
- Universal Design Strategies Used
- Strategies for Projective Design

4.1.1 STAUNTON STATE PARK: TRACK-CHAIR PROGRAM:

Location: Pine, Colorado

Designer: Colorado Parks and Wildlife partnered with Studio Insite to create the trail system of Staunton State Park.

Design Approach: Colorado's newest state park, located 45 minutes from downtown Denver, offers a variety of recreational amenities and natural assets, including a granite ridgeline and waterfall. (studioInsite 2019). One of the site's signature amenities is a track-chair program. This is a movable chair, which allows one to access trails that have limited mobility issues. With a range of options, the hiking/multi-use trails accommodate all people, regardless of what limitations they may have. The multi-use trail options allow for track-chairs and bikes. Overall, this park is a great place for those with disabilities to get into nature for relief and for educational benefits.

Universal Design Strategies Used:
Accessibility is a significant aspect of the park's design. For those who have mobility challenges can utilize the "Track-Chair experience," which is a movable chair that allows them to access and experience three of the park's trails. The user can cover over 8 miles of trails with an $8 day pass (Colorado Parks and Wildlife 2019).

Strategies for Projective Design: Trail systems will be implemented in the projective design to promote accessible options. Also, Staunton State Park will be a good precedent to follow regarding the use of natural materials for design.

Figure 4.1: Staunton State Park Trail (Hodgson, 2019)

Figure 4.2: Track-Chair used at Staunton State Park(Hodgson, 2019)

4.1.2 GRAND TETON NATIONAL PARK: JENNY LAKE:

Location: Grand Teton National Park, Teton County, Wyoming

Designer: Hershberger Design (Landscape Architecture firm in Jackson Hole, WY) partnered with National Park Service Staff, Grand Teton National Park Foundation, and the Sibbett Group in the redesign of Jenny Lake.

Design Approach:
The re-design of Jenny Lake is meant to get the user close to Jenny Lake without harming the existing terrain. Through the design of landscape Trails, front country plazas, interpretive spaces, as well as backcountry trails, Hershberger Design was able to comply with the Architectural Barriers Accessibility Standard while improving safety and adding additional educational opportunities for the people using the site (Hershberger Design 2019).

Universal Design Strategies Used:
Accessibility: Each path, plaza, and furniture piece at Jenny Lake are well thought out so that each visitor is able to have an equal and unique experience.
Engagement: Three deminsional mapping is used to help in further educating the visitor of the surrounding site. Grand Teton National Park app used to take virtual tour and learn more about Jenny Lake.
Enrichment: The design of the main plaza is seamlessly connected to the trail system, which provides access to the lake edge. Along the route there are various opportunities to sit, relax, and learn more about the place.
Multi-Sensory: The Jenny Lake redesign has special features that support the senses of touch and sight. Visitors are able to learn about the site through three-dimensional mapping of the mountain peaks of Grand Teton National Park. A different pavement type of native rocks pave the edges of asphalt pathways help guide the users through the site. Framed views of the mountains or Jenny Lake are created through vegetation and pathway placement.

Strategies for Projective Design: Implementation of ground plane materials, interpretive elements for educational purposes throughout site, framed views, accessible pathways, accessible benches/furniture, multi-sensory elements.


Figure 4.3: Jenny Lake design trail with interpretive signage.(Cross, 2019)

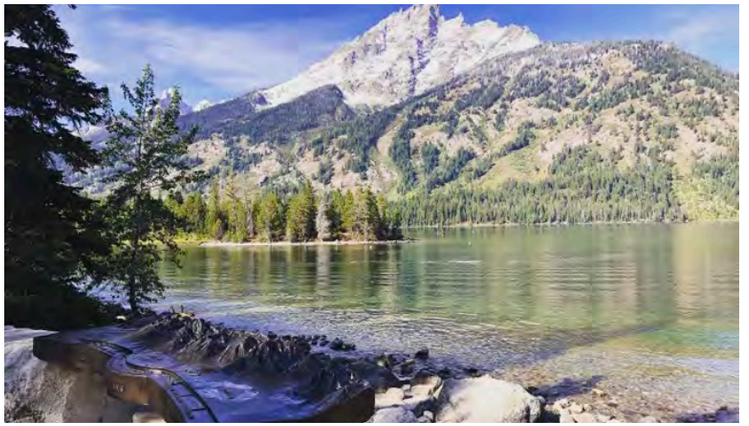


Figure 4.4: Jenny Lake and copper 3D element (Cross, 2019)

4.1.3 STORY MILL PARK:

Location: Bozeman, Montana

Designer: The Trust for Public Land and community of Bozeman, Montana

Design Approach: "Story Mill Community Park with its restored rivers, abundant birds and wildlife, and a rich historical setting provides a place for all to play, celebrate, and connect to nature and to one another for generations to come. At 60 acres, Story Mill Community Park is the City of Bozeman's largest park featuring ample experiences for exercise on 3-4 miles of trails, a climbing boulder and an adventure playground with tree houses, slides and unique climbing features. For our furry friends, an enclosed dog park provides space to roam and play fetch. Family, friends and neighbors gather for performances in the park's hillside amphitheater, recreation programs and camps at the community center, picnics and celebrations in several open-air pavilions, and festivals held on the park's grand lawn (The Trust for Public Land 2018)."

Universal Design Strategies Used:
Accessibility: Accessible pathways connecting main zones of park (playground, event space, grand lawn, community garden). There are also accessible trails through secondary, natural zones of site.
Enrichment: Creating opportunities for learning about native wildlife and plants.
Multi-Sensory: The creation of nodes of experiences throughout park. Rock climbing, accessible playground, community garden, interpretive signage which helps to create educational value.

Strategies for Projective Design: Design nodes of unique experiences, educational opportunities with signage.

Figure 4.5: Accessible Pathways and art elements (Cross, 2019)

Figure 4.6: Story Mill Park: Interpretive Signage (Cross 2019)

4.1.4 COLUMBIA ICEFIELD SKYWALK:

Location: Jasper National Park in Alberta, Canada

Designer: Sturgess Architecture

Design Approach: "The Glacier Skywalk is an architectural tourist experience drawing over 375,000 people per year to experience the Columbia Icefields. The Skywalk functions as an outdoor interpretive exhibit leading the users to a glass-floored cantilever 280m above the Sunwapta Valley. The educational nodes appear as landscape objects, emerging from the geology. The Discovery Vista projects from the face of the mountainside allowing the visitors to experience the grandeur of the glacier at a distance, and the valley below. The natural landscape was the inspiration for the design and also informed the materiality. The thrust-fault geological movement in the area has created a fractal landscape, influencing the architectural form. The angular forms, rusted hues, and warm texture of the Corten steel finish relate to the rocky outcroppings of the surrounding mountains. The glazing mimics the glacial flow below (Sturgess Architecture 2012)."

Universal Design Strategies Used:
Multi-Sensory: In strategic locations, visitors can interact with interpretive exhibits (use of touch and sound).
Accessibility: The pathways meet ADA requirements at 5% or less slopes, made with sturdy paving materials of wood and asphalt.
Engagement: Skywalk was able to tell a story, educate users, and create a unique experience.
Enrichment: Through the use of interpretive panels, the Skywalk is able to educate the users of the site.

Strategies for Projective Design: Creating educational moments throughout the design with multi-sensory exhibits.

Figure 4.7: Columbia Icefield Skywalk (Hollman, 2019)

Figure 4.8: Interpretive Signage (Hollman, 2019)

4.1.5 TONGVA PARK AND KEN GENSER SQUARE:

Location: Santa Monica, California

Designer: James Corner Field Operations LLC

Design Approach: "Tongva Park + Ken Genser Square transformed a former parking lot into a lush landscape of rolling hills, meadows and gardens. The design was shaped by an extensive community process and is now celebrated as an important destination and center for Santa Monica. The most dramatic aspect of the site transformation has been the restoration of its ecosystem - new forest types and amended soils respond to the design's microclimates and showcase a diversity of species specifically suited to each area. It is one of the first large-scale contemporary urban projects to highlight California native plants as significant horticultural features and was a trailblazer for climate-appropriate water use in the public realm. The project's sustainability is boldly evident not only in its ecology and use of water, but also in its diverse social use and vibrancy, as its varied and flexible spaces attract users of all backgrounds (American Society of Landscape Architects 2018)."

Universal Design Strategies Used:
Multi-Sensory: The sense of touch was used throughout design with different ground plane materials, water feature, materials use for the playground's ground plane.
Accessibility: Accessible ramping was incorporated into slopes to get the user up to lookout points of the ocean.
Engagement: Multiple opportunities for users of the site to walk through unique spaces of site, play in water/ playground, relax and sit in many areas to enjoy park.

Strategies for Projective Design: Integrated seating components, accessibility components, zones of activity or educational value.

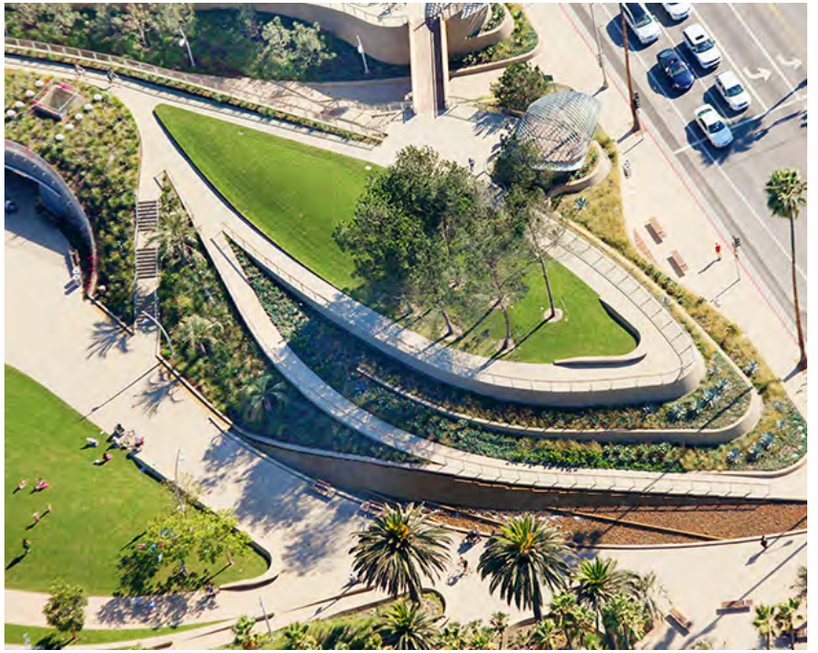


Figure 4.9: Tongva Park and Ken Genser Square Areal (Tim Street-Porter, James Corner Field Operations, 2018)

Figure 4.10: Lookout at Tongva Park and Ken Genser Square (Tim Street-Porter, James Corner Field Operations, 2018)

4.1.6 WOOLWICH SQUARES:

Location: London, UK (Borough of Greenwich)

Designer: Gustafson Porter + Bowman

Design Approach: "Gustafson Porter + Bowman's design is based on the concept that each square embodies an essential quality of Woolwich, whether historic or natural, and seeks to create spaces that are particular to Woolwich. The design used pedestrian movement studies to identify key routes through the town center, and developed these to create distinctive quality public spaces that both enhance the experience of the pedestrian and respond to their needs. Terracing is utilized to improve the usability of the steeply sloping squares, with level routes provided throughout to ensure accessibility for all users. A language of materials and details was developed that incorporated the best practice for seating, ramps, lighting and planting. Natural stone was chosen for its robustness and appearance, and its colors tied into the palette of the wider town center. The robust detailing of the design has allowed the spaces to be well maintained by the council (Gustafson Porter + Bowman 2012).

Universal Design Strategies Used:
Accessibility: Pathways have appropriate slopes and accessible seating options.
Multi-Sensory: A wading water feature supports sense of touch.

Strategies for Projective Design: Multi-Sensory elements can be embedded in the ground plane. Provide built-in seating components and enforce design geometries which focus on primary zones of program.

Figure 4.11: Woolwich Squares (Whippet, 2017)

Figure 4.12: Woolwich Squares (Kleon3, 2015)

4.1.7 MCINTIRE BOTANICAL GARDEN: MASTERPLAN FOR RESILIENCY AND HEALING (CONCEPTUAL STAGE):

Location: Charlottesville, Virginia

Designer: Mikyoung Kim Design

Design Approach: "As a place of resiliency, discovery, inclusiveness, and healing, this master plan incorporates a vision for a premier botanical garden in Central Virginia that showcases the natural systems of the Piedmont region. Driven by the community's insights and aspirations, this masterplan activates the site's ecology in novel ways and guides that creation of a compelling new destination that builds social infrastructure and fosters social healing. Defined by the site's steep topography and woodland conditions, the masterplan creates a series of terraced gardens and discovery walks. The plan brings to life a garden in the woods focused on inclusion, exploration, and the natural world's transformative power to start a dialogue and heal a community (McIntire Botanical Garden: Masterplan for Resiliency and Healing 2019)."

Universal Design Strategies Used:
Accessibility: Pathways across the site are designed for all people to use.
Engagement: Educational zones help teach visitors about sustainability practices and the surrounding environment.

Strategies for Projective Design: Preservation of natural environment, accessible pathways, and educational zones (interpretive media for more engagement of the site).

Figure 4.13: McIntire Botanical Garden Concept Image (Mikyoung Kim Design 2019)

Figure 4.14: McIntire Botanical Garden Concept Image (Mikyoung KimDesign 2019)

4.1.8 DEMONSTRATION GARDENS: CHICAGO BOTANIC GARDEN:

Location: Glencoe, IL

Designer: Pashek + MTR

Design Strategy: "Enabling Garden: Raised beds, container court, vertical garden walls, water features, shade structure and teaching pavilion, roll-under beds and trays for lap gardening, hanging baskets on pulleys, modified/ ergonomic tool display, tactile map, high contrast paving, sensory-rich planting, accessible lawn with transfer area. Fruit & Vegetable Island: 4 acres of gardens with kitchen amphitheater, greenhouse, maintenance center, tool shed, and multiple fruit/vegetable gardens." (Pashek + MTR 2020)

Universal Design Strategies Used:
Accessibility: The garden accommodates those with limited mobility, allowing them to participate fully, with options for lap gardening. Other amenities include an a manicured grass lawn that is easily accessible for those in wheel-chairs, amphitheater for events, interpretive media to better understand how honey is made and to learn more about agriculture.
Multi-Sensory: Demonstration Gardens have edible plantings exhibits like beehives and composting (Pashek + MTR 2020).
Engagement: The garden provides opportunities to learn about gardening and how to properly maintain vegetation.
Enrichment: Learning where produce comes from, and how to properly maintain/prepare food, creates an enriching and immersive experience.

Strategies for Projective Design: The projective design can incorporate accessible design (plaques and planter beds were at level for all people to use), multi-sensory exhibits.

Figure 4.15: Demonstration Gardens (Google Earth 2019)

Figure 4.16: Demonstration Gardens (Google Earth 2019)

4.2 PRECEDENT STUDY FINDINGS:

Through review of the eight precedents, several overlapping themes, specific to universal design emerged. Below is a bulleted list of the takeaways that can be applied to the Mammoth Hot Springs projective design.

- **Accessible** Pathways: integrating pathways into the landscape's existing terrain.
- **Multi-Sensory:** changes in ground pavement/ three deminsional mapping elements to touch, signage with audio.
- **Enrichment:** Clear and defined circulation and framed views.
- **Engagement:** interpretive media or signage that is both educational and wayfinding around site.
- Multiple seating options/**accessible** furniture.
- Height placements of handrails, specific bench/seating placement.

4.3 INTERVIEW SUMMARY:

Three individuals, with subject matter expertise, were identified for interviews. Interviewees included:

Leigh Dunworth-
- **Affiliation:** Accessibility Technician and Landscape Architect at Yellowstone National Park
- **Subject matter expertise:** works with National Park Service and knows design guidelines to follow

Jessica Brown-
- **Affiliation:** Accessibility Technician and Landscape Architect at Grand Teton National Park
- **Subject matter expertise:** works for National Park Service, works on Universally Designed projects with Landscape Architecture Firms, and knows design guidelines to follow

Hans Flinch-
- **Affiliation:** Designer at Hershberger Design in Jackson Hole Wyoming
- **Subject matter expertise:** Landscape Architect for Hershberger Design, Designer for Jenny Lake Re-design project in precedent studies, knows design guidelines to follow in National Park Service

A standard set of questions were asked of each interviewee, with additional questions that pertained specifically to their knowledge base, or to further clarify specific topics. Findings revealed how aspects of universal design are being incorporated into different park sites, which helped to inform goals for the Mammoth Hot Springs projective design.

Leigh Dunworth is an Accessibility Technician and Landscape Architect at Yellowstone National Park. She helped in creating the *Accessibility Guide for Yellowstone National Park,* which highlights the main attractions of Yellowstone and showcases the accessible pathways, trails and visiting centers in the park. Work that the park has done for accessibility and what they will continue to do in the future was discussed in the interview. Also, a big discussion point was the park's overall success of the continual efforts and additional questions regarding the inclusive design strategies at Yellowstone National Park were answered.

Jessica Hendrix-Brown is the Accessibility Coordinator and Landscape Architect at Grand Teton National Park. In July of 2019, Grand Teton National Park released information on an Accessibility and Transition Plan for the highly visited places throughout the park. Jessica was one of the main people to organize this information. This booklet addresses the sites as is, and the goals of how the park staff will begin to illuminate barriers. In the interview, inclusive design found in Grand Teton National Park, seasonality of the park/materiality of the inclusively designed spaces, and design guidelines were discussed.

Hans Flinch is a Landscape Architect for Hershberger Design in Jackson Hole, Wyoming. Hershberger Design's work portfolio includes projects of different types and scales, including: memorials, to private residential design, to overall master planning. Hershberger Design, with the collaboration efforts of the National Park Service Staff, Grand Teton National Park Foundation, and the Sibbett Group created an updated plan of Jenny Lake in Grand Teton National Park. This updated plan addresses accessibility, enhances existing plazas, trails, and interpretive spaces ("Hershberger Design" n.d.). For the interview with Hans, the Jenny Lake re-design, inclusive design techniques in a National Park setting, visitation and feedback from users were discussed.

4.3.1 LEIGH DUNWORTH:

When interview took place: November 20, 2019
Type of interview: Through email

The first round of questions focused on how Yellowstone National Park is addressing universal or inclusive design strategies. In Yellowstone National Park, there are institutional barriers to implementing inclusive design. Funding is currently tight within the NPS, and other needs are taking a priority over accessibility projects right now. "Sometimes it's a challenge to get our maintenance staff or contractors to build projects that meet ABA standards. Some people see inclusive design as an added expense." Yellowstone National Park is trying to overcome these barriers by training park employees on the importance of universal design. Also, Dunworth specifically uses her title as the Park Accessibility Technician to "continue to share information with park staff to provide awareness of the importance of universal design, through the review of site plans, construction drawings, and design that ensures compliance with ABA standards."

The National Park System seems to be making good progress towards its use of inclusive design, meeting one of the goals in their "All In! Accessibility in National Parks" program. Yet, there may not be a lot of accountability, beyond parks writing self-assessments and transition plans. Dunworth suggests that "The NPS needs a service-wide initiative to improve accessibility." When it comes to inclusive design, it is important to think about the extra maintenance of trails and boardwalks that may be required. Teaching workers in the National Park to properly care for these places is the first step to a more equal experience for

the park visitors. With the summer months being very busy for the parks, Dunworth says that the maintenance staff focuses on overall circulation within the park. However, the main focus at the moment is on vehicular traffic. parking and how the visitors will be able to see the popular features in an equal way. The secondary focus is on cycling route maintenance, and pedestrian trails. Dunworth suggests that the park's "Cyclic maintenance, especially transitions between walking surfaces and trails" needs improvement.

Yellowstone National Park follows the Architectural Barriers Act of 1968, Rehabilitation Act of 1973, Accessibility standards for Outdoor Developed Areas (2014), and other NPS Management Policies for any new projects or re-designs. Although funding is limited, Yellowstone Forever is the primary education and fundraising partner for projects. Dunworth states that, "Many individuals and corporations are also able to donate money to the park through Yellowstone Forever."

4.3.2 JESSICA BROWN:

When interview took place: December 11. 2019
Type of Interview: Through email

Jessica Brown works for Grand Teton National Park as a Landscape Architect and Accessibility Coordinator. Inclusive/universal design seems to be a vital part of Grand Teton National Parks, (GRTN) new "Self Evaluation and Transition Plan," but Brown said that universal design still comes with certain challenges when attempting to implement it within the park. "Some common barriers include slope, disturbance area allowed- usually for universal design, you need additional space for wider paths or accessible connections. Universal design is an afterthought which means it does not get included in the designs. It is important to bring universal design in during schematic or concept development phase of design to ensure that it's incorporated throughout the whole design process."

Although universal design is looked at as an afterthought, Brown and other employees are helping to spread awareness about the importance of this type of design and the maintenance process that follows with it. A Park Accessibility Team was formed to help initiate universal design strategies into the park and begin to keep it as a constant design standard for new projects throughout GRTN. When it comes to design standards, GRTN is very similar to Yellowstone National Park on what they follow when designing projects with Universal Design in mind. The Architectural Barriers Act of 1968, Rehabilitation Act of 1973, NPS Accessibility Task Force strategic plan, and other NPS management policies are the main guidelines that are followed.

Overall, Grand Teton National Park is making progress towards more universally designed spaces with newly re-designed spaces such as the Jenny Lake re-design and the addition of an "Interpretive Media" portion of the "Grand Teton Places app." Brown says that the progress has been very significant the park's success, but vehicular circulation, parking, pedestrian/bicycle circulation remains to be the most important challenge to further address.

4.3.3 HANS FLINCH:

When interview took place: December 13, 2019
Type of Interview/Duration: Phone call | 15:23

Hans Flinch works for a Landscape Architecture firm in Jackson Hole Wyoming that does work in National Parks. This interview was structured a little bit different, because of his experiences. Similar questions were asked

as the previous interviews, but specifically addressing the Jenny Lake re-design. The re-design for Jenny Lake was completed in summer 2019 and enforces universal design throughout the site with accessible paths, accessible furniture, accessible signage, interpretive media with multi-sensory elements to touch and hear. Flinch suggested that he was surprised by the way people were using the widened pathways, because many thought "these wheel-chair friendly paths were bike paths. Grand Teton is known for their healthy amount of bike paths, but that is something that we have noticed how people are using the new Jenny Lake design unexpectedly."
Grand Teton National Park has had a rise in visitation rates, so it was clear that Jenny Lake needed to be updated because visitors were creating social trails and eroding away the banks of the lake, due to there being no clear accessible routes to the lake's edge. These accessible routes had high praise from visitors, because they were able to enjoy the lake in an equal manner as anyone else would. Also, due to visitation rates, vehicular parking was addressed in depth and the design was able to grant more parking, with options to bus to this part of Grand Teton National Park.

The biggest barrier to including universal design into a designed project is money. Flinch said, "We had to go through many value engineering iterations. The project was different than it was first drawn out, but I believe that it was better in the long run because of it." When working in a National Park, the firm was held under a different set of design guidelines to follow than what they would in projects outside of the parks. Flinch said that this was a challenge to uphold their original design to the ABAAS standards. He said, "With ABAAS, we had to reevaluate our design portion of the rock beach because it was literally going to be a concrete surface going straight into the water, which you can't have. I think the design is cooler now, because the concrete pad is designed to flood enough for someone to roll their wheelchair in the water and actually be immersed. As a firm, we new what our goal was, so we decided to look through another lens and make a better design than what we decided for in the first place."

4.4 INTERVIEW FINDINGS:

Throughout the interviews, several overlapping themes, specific to universal design, emerged. These main points were emphasized repeatedly:

- **Enrichment:** Vehicular Parking- smoother transition through NPS attractions (higher park attendance rates).
- **Multi-model traffic circulation:** clearly defined pathways and trail systems/roads for pedestrians, bicycles, and vehicles through signage and wayfinding.
- **Accessibility:** Eliminating all physical barriers around each site.
- **Accessibility:** Site should meet ABA and ABAAS standards. (They are acts passed to be followed by governmental agencies).
- **Multi-Sensory:** Interpretive Media for visitors to learn more aobut the site.
- Follow preservation laws of Yellowstone.

4.5 SITE INVENTORY AND ANALYSIS:

The following section investigated the Mammoth Hot Springs site, a popular attraction in Yellowstone National Park. This section examined 11 categories that highlights further information about the site:

- **Yellowstone History and Attractions:** The history of Yellowstone National Park and how all the attractions are connected.
- **Site History:** The history surrounding Mammoth Hot Springs, the importance behind the site, and the geological features throughout Mammoth Hot Springs.
- **Micro-climate:** The climate of Mammoth Hot Springs.
- **Site Identity:** The size of the site, views, spring locations and location within the region/Yellowstone National Park.
- **Site Elevation:** Examining the site's elevation through visual/sectional form.
- **Site Inventory/Analysis** of Hymen Terrace and Upper Terraces through pictures taken of site.
- **Vegetation:** Highlights the existing vegetation of Mammoth Hot Springs.
- **Amenities:** Location of bathrooms, lodging, bus stops, and food location near the site
- **Circulation:** Examining the existing trail system around the site and parking/type of parking around site.
- **Site Opportunities:** Mapping of locations based on opportunities within Mammoth Hot Springs.

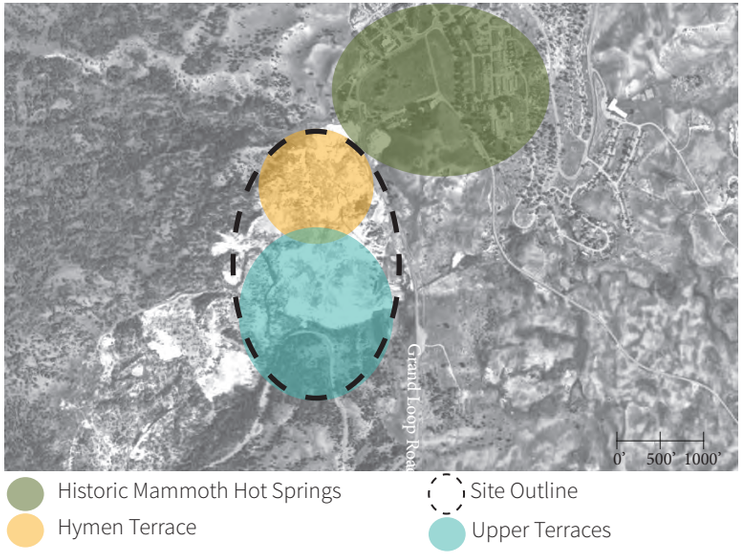


Figure 4.17: Context Map of Mammoth Hot Springs Region (Cross, 2020)

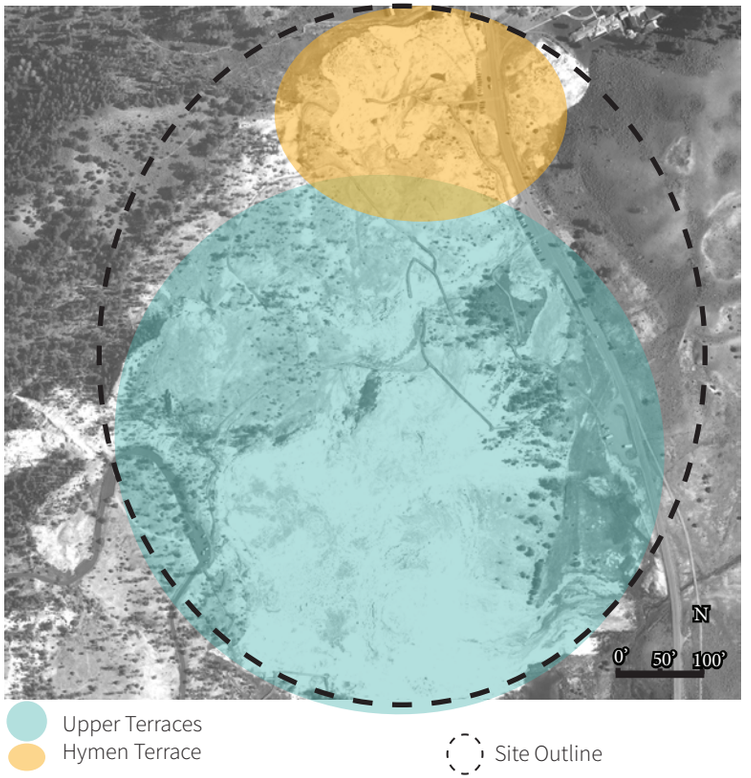


Figure 4.18: Scope of Project (Cross 2019)

4.5.1 YELLOWSTONE HISTORY AND ATTRACTIONS:

Yellowstone National Park was established as the first National Park in 1872 (NPS 2017). Prior to its establishment, many expeditions occurred in the area because of the talk about the interesting geological features found there. The Hayden Expedition of 1871 was one of the most notable because Thomas Moran came on the expedition to paint the geologic features and surrounding landscapes of Yellowstone (National Park Service 2017). It was these paintings, created by Moran, that helped officials decide to make Yellowstone the first national park (National Park Service 2017). When the park was administered by the U.S. Army between 1886-1918, preservation laws took effect because too many visitors were taking "souvenirs" from the popular attractions, littering, and generally not taking proper care of the park (National Park Service 2019).

Yellowstone National Park covers 3,472 square miles with many attractions dispersed through the site. Below is the miles between the main attractions found at Yellowstone.

- North Entrance to Mammoth Hot Springs: 8 miles on Hwy 89
- Mammoth Hot Springs to Grand Canyon of Yellowstone: 32 miles by Grand Loop Road
- Canyon Village to Fishing Bridge along Yellowstone Lake: 35 miles by Grand Loop Road and US- 14 E
- Fishing Bridge (Western side of Yellowstone Lake) to Grand Prismatic Springs: 44.5 miles via US-20W, US-191 N, US-20W, US-287 N, and US-89 N
- Grand Prismatic Springs to Old Faithful Geyser: 13.5 miles by US-191 N | US-20 W | US-287 N | US-80 N
- Old Faithful Geyser to West Entrance (West Yellowstone): 30 miles by US-191 N | US-20 W | US 287 N | US-80 N

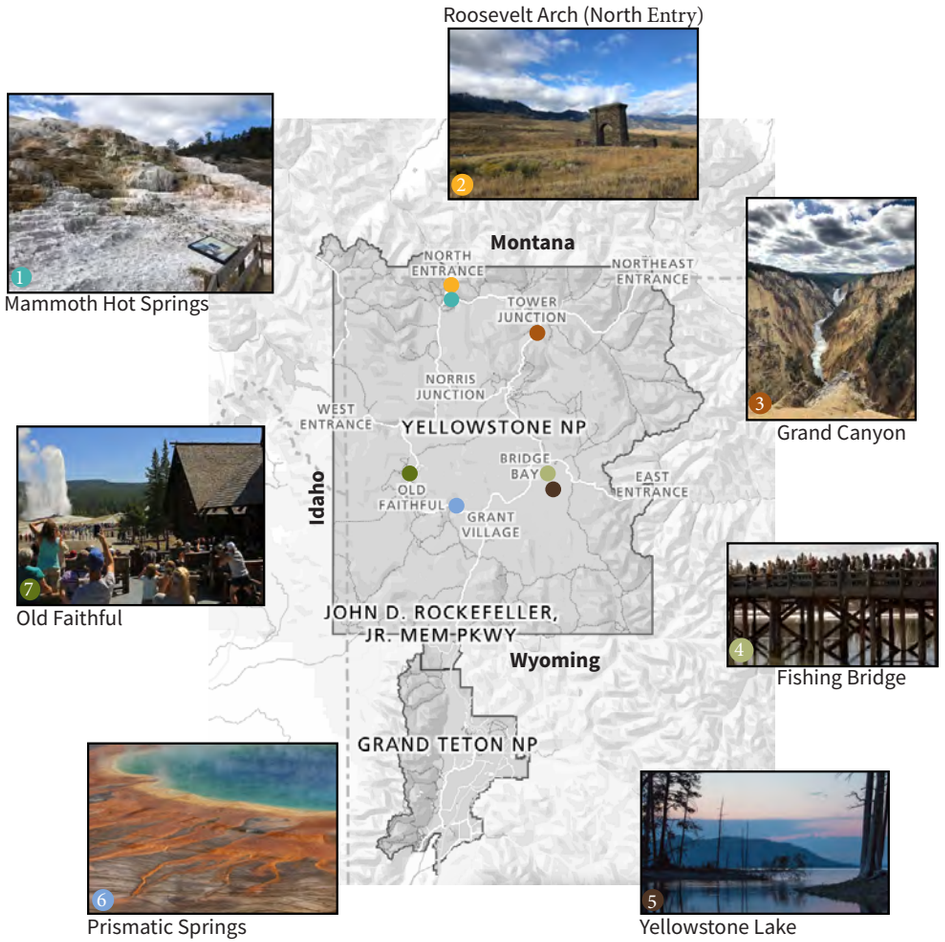


Figure 4.19: Most visited attractions in Yellowstone National Park (Cross 2020)

4.5.2 SITE HISTORY:

The context surrounding Mammoth Hot Springs is very historic in respect to Yellowstone National Park. Mammoth Hot Springs is home to the original Fort Yellowstone, which is the location where the U.S. Army administered the park during the early 1900s (National Park Service 2019). The Fort was established in close proximity to Mammoth Hot Springs because soon after Yellowstone became a National Park, there were issues with visitors harming the springs/geysers and killing animals (National Park Service 2019). The site was notorious for visitors coming to "seek relief from ailments in the mineral waters (National Park Service 2019)." Preservation laws have since made it to where visitors aren't allowed to physically get into the springs, but paths and trails have been added to provide close access. To this day, this historic district of Mammoth Hot Springs remains the park's administrative and concession headquarters (National Park Service 2019).

Mammoth Hot Springs is full of many "intricate fountainlike" travertine terraces that are formed from surrounding limestone (National Park Service 2019). These travertine terraces were created from thermal water continuing to "rise through the limestone, carrying high amounts of the dissolved limestone (calcium carbonate)" (National Park Service 2019). Carbon dioxide is released to the surface (from the thermal water underground) and forms travertine surfaces from the calcium carbonate (National Park Service 2019). Many scientists believe that Mammoth's hot springs might be fueled by the "same magmatic system that fuels other Yellowstone hydrothermal areas", but there are other beliefs that basalt may be the heat source (National Park Service 2019). The site has five different springs, with six different terraces: Main Terrace, Cleopatra Terrace, Jupiter Terrace, Minerva Terrace, Hymen Terrace, and Opal Terrace.

Figure 4.21 shows the terrace/spring location throughout the site.

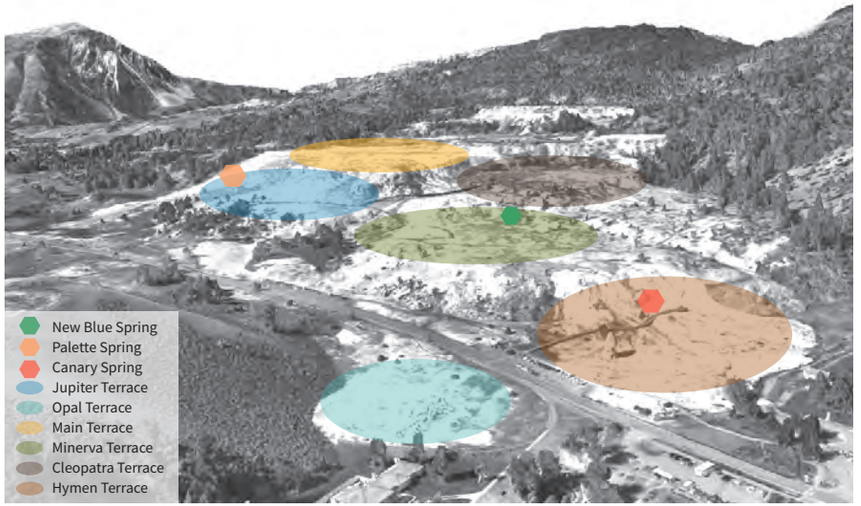


Figure 4.21: Terrace/spring locations throughout Mammoth Hot Springs. (Cross, 2020)


Figure 4.20: Palette Spring in the Hymen Terrace (travertine terraces) (Cross, 2019)

4.5.3 MICROCLIMATE:

Yellowstone National Park's microclimate changes vastly depending on the season and elevation. Since the majority of Yellowstone is above 6000 feet in elevation, there are significant variations in the temperature and precipitation. The following summary contains information provided by the {National Park Service(11) 2019}. At Mammoth Hot Springs, daytime temperature stays between 70 and 80 degrees Fahrenheit in the months June-August, with afternoon thunderstorms occurring frequently (National Park Service 2019). The winters are very cold, with daytime temperatures ranging from 15-30 degrees Fahrenheit from the months of November-February. It is normal for the Mammoth Hot Springs area to receive at least 150 inches of snowfall. Areas with higher elevation can expect to see double that amount. The spring and fall seasons are shorter with daytime temperatures ranging from 30 to 60 degrees Fahrenheit. During these two seasons it is not uncommon to see intense snowfall of up to 12 inches in a 24 hour period. Mammoth Hot Springs and its surrounding eco-region do not receive as much accumulation as other areas in Yellowstone with higher elevation. Mammoth Hot Springs is situated in the rolling hills with the mountainous peaks to the west of the site. Table 4.0 shows the precipitation averages for each month throughout the year.

The wind speed of Mammoth Hot Springs is slower than its surrounding context due to its lower elevation (Meteo-Blue: Weather Close to You 2020). The prominent wind direction is coming from the south western direction, with the highest wind speed averaging between 9mph-18mph during spring. The lowest wind speeds are in the summer, averaging 3mph-12mph (Climate Yellowstone National Park 2020). Table 4.1 shows the wind speeds throughout the year.

	Average High	Average Low	Average Rainfall	Average Snowfall
Jan	24 F	1 F	1.96 in	35 in
Feb	30 F	4 F	1.77 in	25 in
Mar	38 F	12 F	1.82 in	26 in
Apr	47 F	21 F	1.51 in	16 in
May	58 F	29 F	2.19 in	6 in
Jun	69 F	36 F	2.21 in	1 in
Jul	78 F	41 F	0.84 in	0 in
Aug	77 F	38 F	1.36 in	0 in
Sep	66 F	30 F	1.47 in	1 in
Oct	52 F	22 F	1.30 in	8 in
Nov	33 F	11 F	2.01 in	23 in
Dec	24 F	1 F	2.30 in	30 in

Table 4.0: Temperature average high and low, and average rainfall and snow throughout the year. (Cross, 2020; Meteo-blue: Weather Close to You 2020)

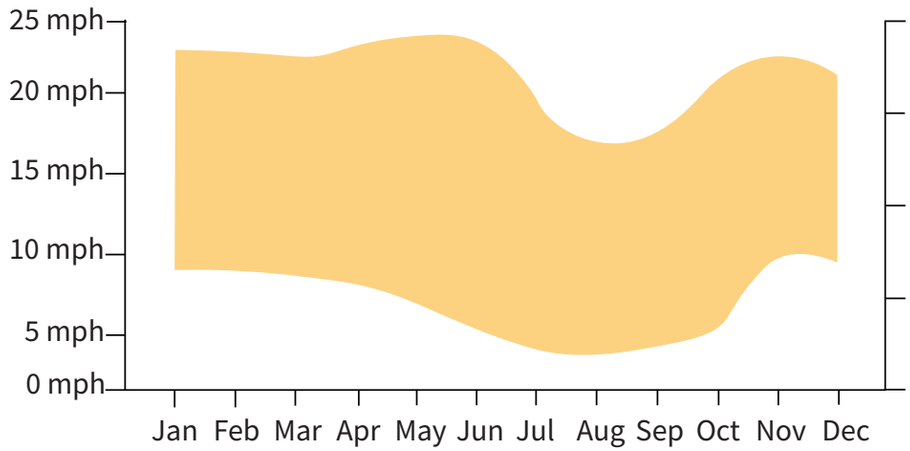


Table 4.1: Wind speed average highs and lows throughout the year in Yellowstone. (Cross, 2020; Meteo-blue: Weather Close to You 2020)

4.5.4 SITE IDENTITY:

The Mammoth Hot Springs site spans about 14 acres, including its six terraces: Main Terrace, Cleopatra Terrace, Jupiter Terrace, Minerva Terrace, Hymen Terrace, and Opal Terrace. Figure 4.23 shows these terraces and specific spring locations. Currently, there are five parking lots within close proximity to the attraction. Each of the five trailhead entries into the site start from the five different parking lots, which are all located off Grand Loop Road. Also, Grand Loop Road connects Mammoth Hot Springs to Historic Mammoth Hot Springs, which is the location of the park headquarters and many other amenities. This will be further addressed in 5.2.9 amenities sub-section.

Because of the topography change of 200 feet in elevation, the views of the surrounding hills are very beautiful. Figure 4.22 shows the view from the main terrace.

Figure 4.22: View from the top of the Main Terrace in Mammoth Hot Springs. (Cross, 2019)

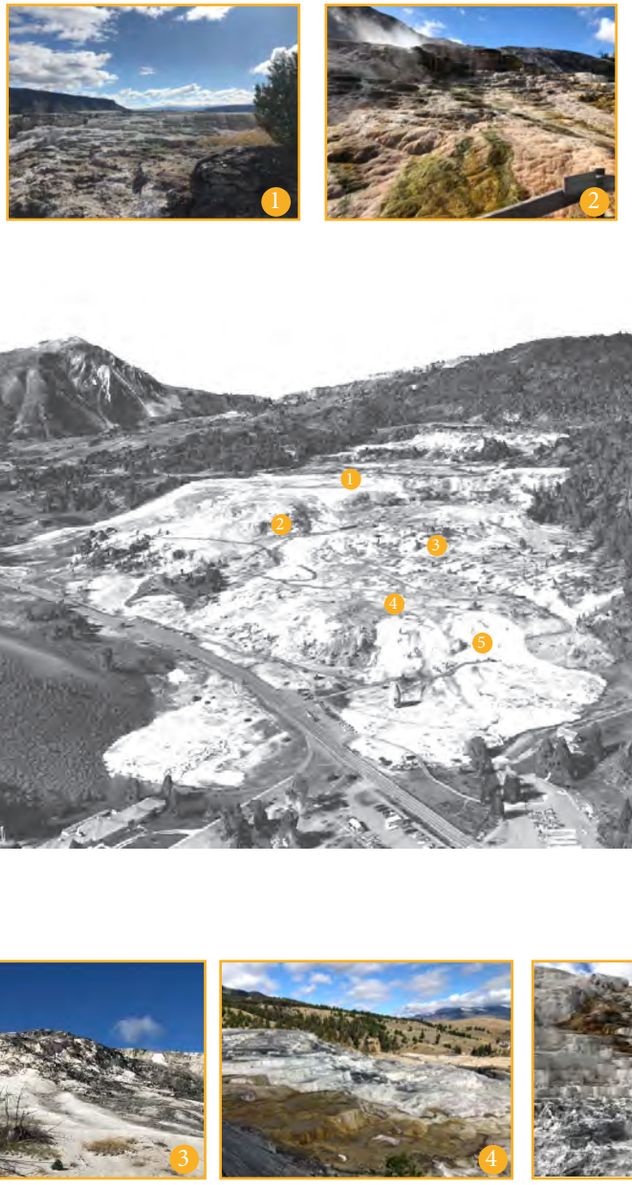


Figure 4.23: Photographs of terraces throughout the site. (Cross, 2020)

4.5.5 ELEVATION OF SITE:

There is over 200 feet in elevation change across Mammoth Hot Springs, from the top of the Main Terrace to the bottom at Hymen Terrace. This change in elevation creates challenges for accessibility. Table 4.2 shows a section cut through the middle of the site, starting at the Main Terrace and ending at the Hymen Terrace. The elevation map is also highlighted in map of Figure 4.24. Lastly, Figure 4.25 shows a 3-deminsional view of the site.

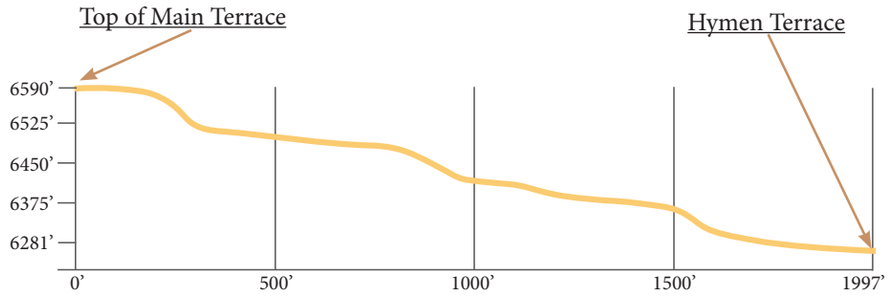


Table 4.2: Sectional cut of site: Main Terrace to Hymen Terrace (Cross 2020)

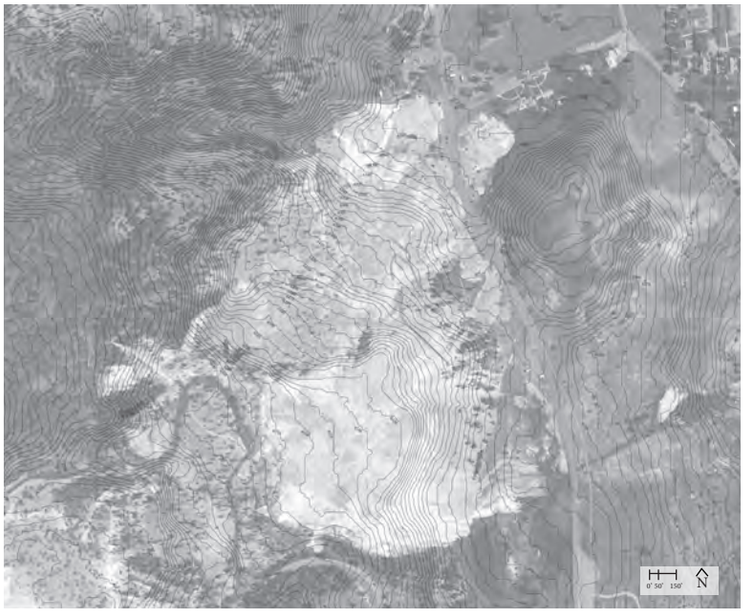


Figure 4.24: Contour map showing every 10 ft. (Cross 2020)

Figure 4.25: Three deminsional view of the site to show the topography (Cross 2020)

4.5.6 HYMEN TERRACE: LIBERTY CAP INVENTORY AND ANALYSIS:

The Hymen Terrace: Liberty cap is one of the main focus areas of the projective design. On-site observations and photos were taken September 2019.

1: Typical view of wooden boardwalk. The wooden boardwalks are well-worn and create an uneven surface in certain areas.

2: This wooden boardwalk is adjacent to Hymen Terrace entry boardwalk, looking west towards the Palette Springs. At this location, the pathway slope begins to increase to approximately 6.0%.

3: Main spring attraction at the Hymen Terrace. There is minimal signage in this area, most of which is not easily accessible for visitors in wheelchairs.

4. Parking lot near Hymen Terrace. A single dirt path connects the parking lot to the interconnected boardwalks. Its uneven terrain is challenging to walk on.

5. Main path to Hymen Terrace and Palette Spring location. With a lack of handrails and a worn wooden surface, this path is not fully accessible.

6. Entry signage into the site. The graphics lack educational or multi-sensory aspects. This standard signage is not accessible (very tall and with no braille/multi-media) creating challenges for those who experience disabilities to enjoy it.

7: Boardwalk connection to the Hymen Terrace. The slope percentage is a bit steep and needs to be re-evaluated based on accessibility. This boardwalk is very warn with uneven surfaces and with no handrails.

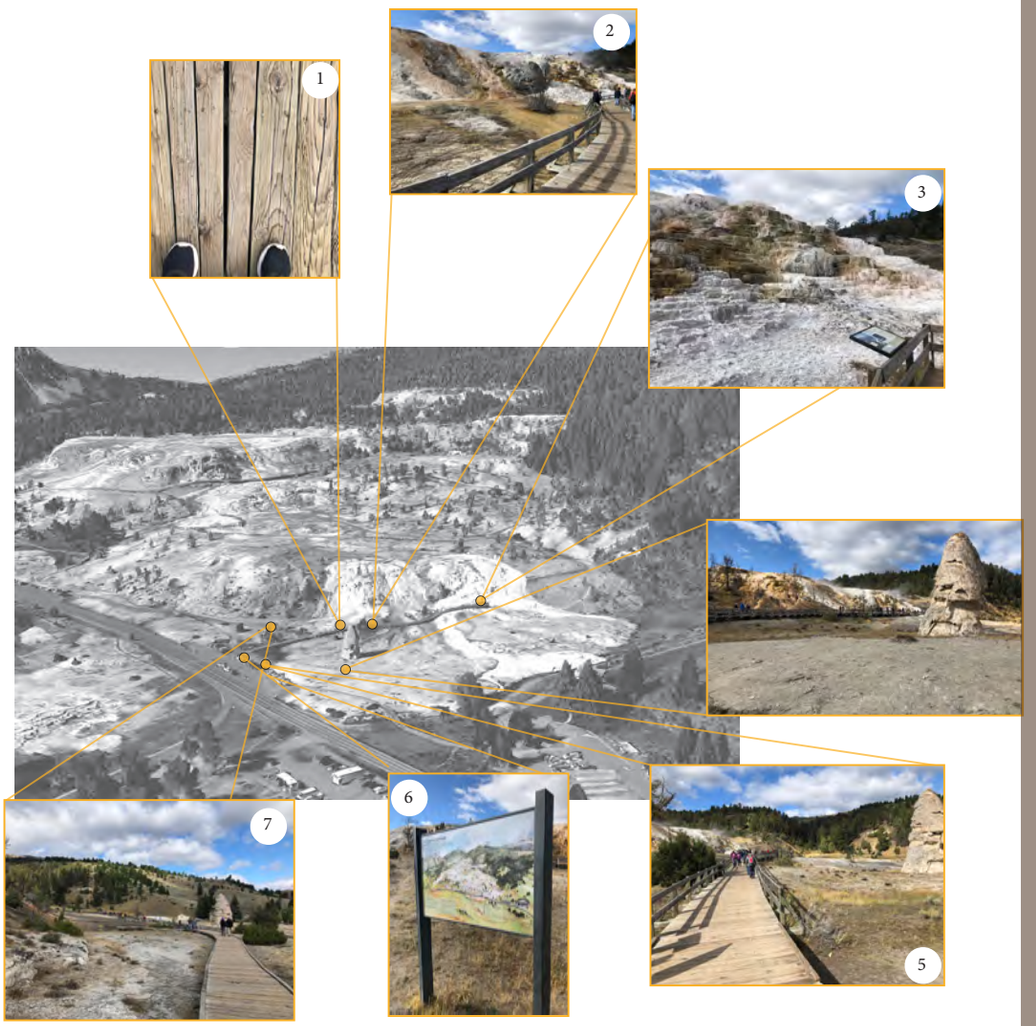


Figure 4.26: Lower Terrace Inventory and Analysis (Cross 2020)

4.5.7 UPPER TERRACE(S) INVENTORY AND ANALYSIS:

Specific upper terraces will be the secondary focus of the projective design. On-site observations and photos were taken September 2019.

1: Accessible boardwalk adjacent to Jupiter Terrace. Though the boardwalk itself meets accessibility standards, there is no accessible route to get to this area due to stair connections.

2: View from the top of the Main Terrace.

3: Typical signage for each spring. This signage is very minimal and challenging for everyone to read, due to a lack of multi-media language and its physical placement.

4: Typical bump-out spaces for seating along the boardwalk. Bump-out space could be more efficiently designed with educational signage and more specific seating placement.

5. Bump-out space by the Minerva Terrace. Because the bench abuts the edge of the boardwalk, it precludes seating on both sides.

6: Trail down to main parking lot. This boardwalk has four sets of stairs, which prevents access for those with limited mobility. The wooden boardwalk is deteriorated along the steps, making it especially precarious for some visitors.

7: Trail connection through vegetated space in Mammoth Hot Springs. Trail is connected to path and has 3 levels of stairs leading to a more accessible path boardwalk along Jupiter Terrace.

Figure 4.27: Upper Terraces Inventory and Analysis: Closer look at the site. (Cross 2020)

4.5.8 VEGETATION:

Due to the unique geological nature of the site, with poor soils filled with limestone and the calcium carbonate solution, there is very little vegetation within the area. Although the site primarily lacks vegetation, there are some patches of a coniferous mix within the site. The primary vegetation that surrounds the site includes species of Rocky Mountain juniper, limber pine, and lodgepole pine (National Park Service (13) 2019). Due to calcium carbonate solution flowing from the site's terraces, vegetation only thrive in zones that are out of the carbonate's flow zones.

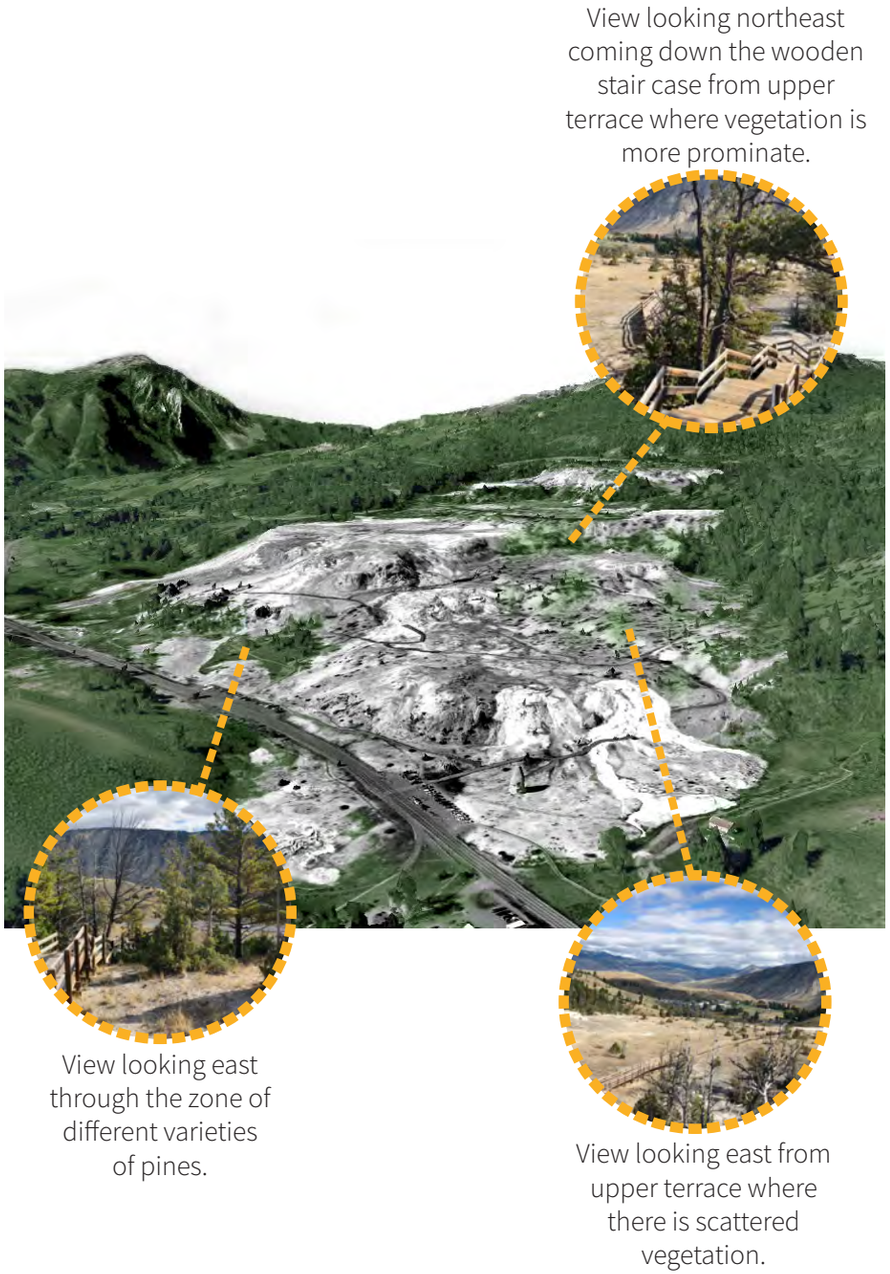


Figure 4.28: Vegetation on Site and surrounding context. (Cross 2020)

4.5.9 AMENITIES:

The Historic Mammoth Hot Springs are a half-mile north of the Mammoth Hot Springs attraction. This proximity is convenient for visitors of Yellowstone who are going to see the Mammoth Hot Springs attraction. The amenities found in the Historic Mammoth Hot Springs district are as follows:

- Two restaurants: Mammoth Terrace Grill and Mammoth Dining Room
- Two General Grocery Store
- Gas Station
- Yellowstone Park Headquarters
- Albright Visitor Center and Museum
- Outfitters business for the organization of backpacking trips
- Yellowstone Federal Credit Union
- Camping Areas
- Mammoth Hot Springs Hotel and Cabins
- Residential homes for park staff
- Post Office
- Public Restrooms

Figure 4.29 shows the amenities, which are existing and located close to Mammoth Hot Springs.

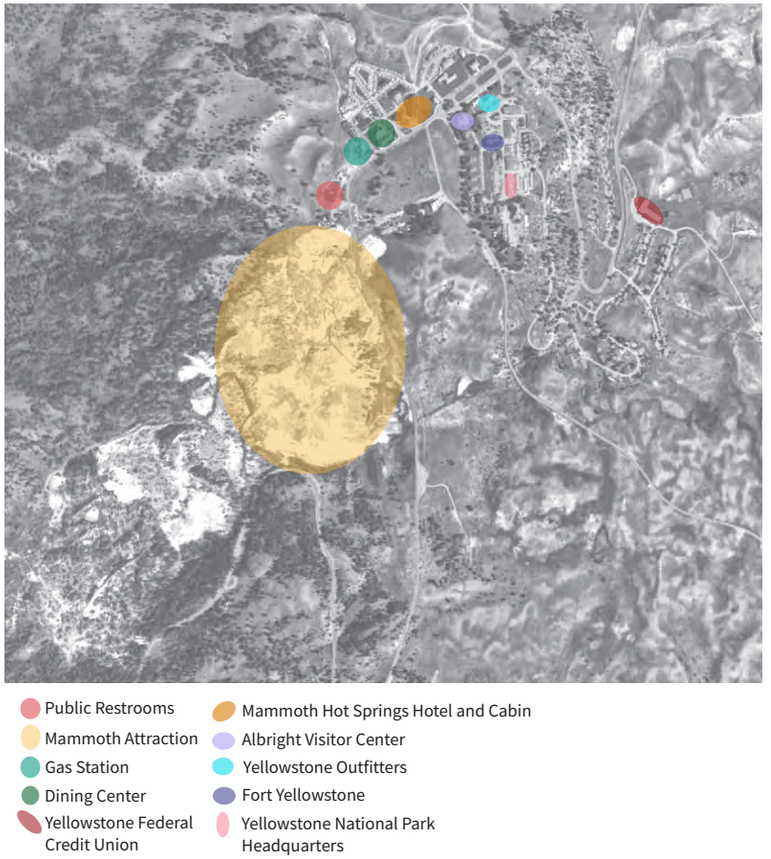
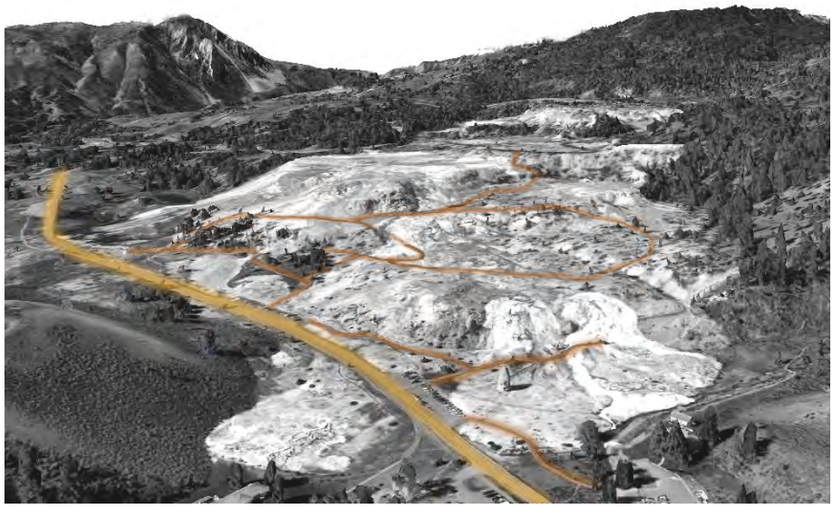


Figure 4.29: Amenities in the general region of Mammoth (Cross 2020)

4.5.10 CIRCULATION:

The circulation system at Mammoth Hot Springs favors abled bodied visitors. There are a few portions of the trails that are accessible, but some without proper access, exclude those who rely on a wheelchair, cain, or crutches to get around. Figure 4.30 shows the existing trail system of Mammoth Hot Springs with both accessible and inaccessible trails.

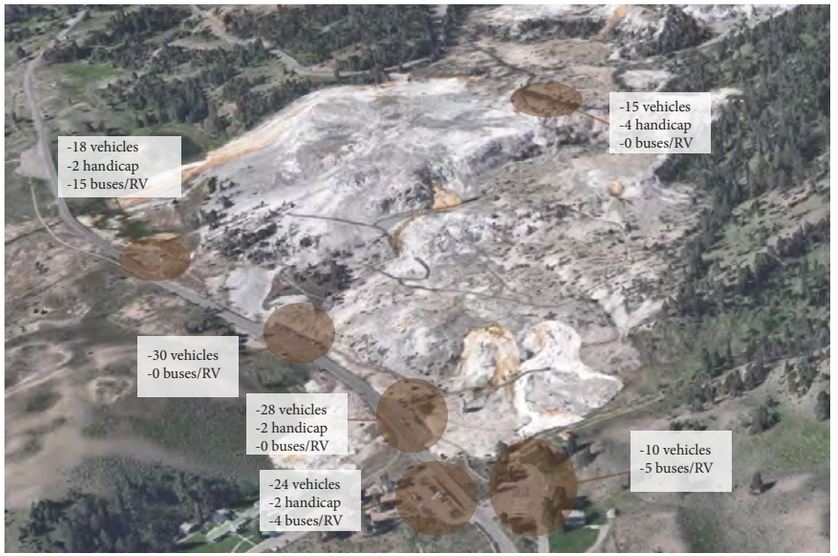
There are 6 parking lots surrounding Mammoth Hot Springs. Figure 4.31 shows how many spots are allotted for each parking lot. Altogether, the 6 parking lots have 120 vehicular parking spots, 10 handicap parking spots, and 24 bus/RV spots. Additionally, some parking unofficially occurs on the side of the road, due to vehicular overflow.



Grand Loop Road

Trail Circulation

Figure 4.30: Existing circulation of the site (Cross 2020)



Parking Spots | Total vehicular spots: 125 vehicles, 10 handicap spots, 24 buses/RV

Figure 4.31: Parking zones surrounding Mammoth Hot Springs(Cross 2020)

4.5.11 SITE OPPORTUNITIES:

Based on the site inventory and analysis, there are a few opportunities that Mammoth Hot Springs offers. Due to Historic Mammoth Hot Springs being so closely connected to the site, Hymen Terrace shows an opportunity to become the entry into Mammoth Hot Springs. This area has potential of educated users more about the site's history and geological importance before the user moves further into the site. There's continual opportunity for users to have extended educational signage zones throughout Mammoth Hot Springs. These zone opportunities are found closely connected to each terrace. Lastly, Mammoth Hot Springs has a specific soil chemistry that lacks proper nutrients for vegetation to thrive. Due to this issue, vegetation will only grow in one specific area of the site. This portion of the site shows opportunity for the creation of a more secluded, educational zone.

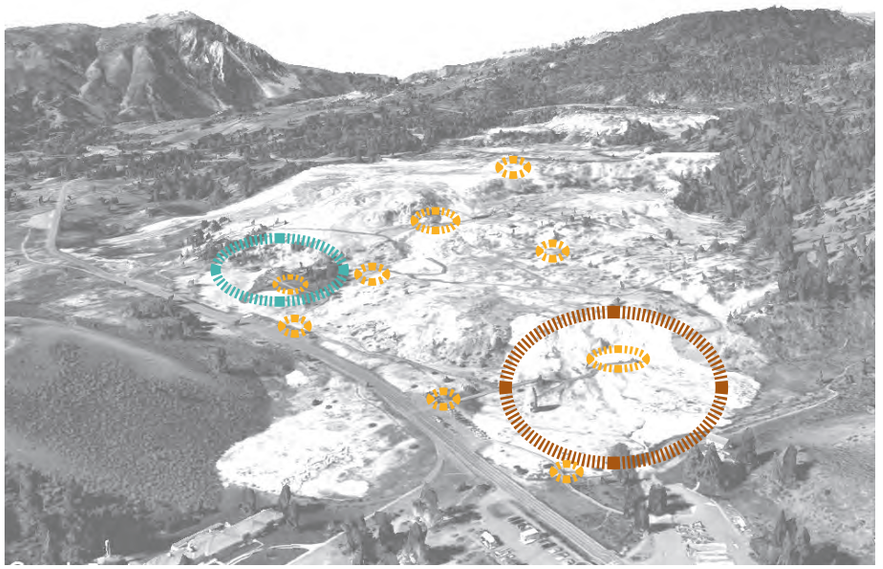


Figure 4.32: Site opportunities for entry, educational zones, and exploration zones (Cross 2020)

Figure 5.0: Liberty Cap at Hymen Terrace (Cross 2019)

CHAPTER 5:

Outcomes

5. OUTCOMES:

Informed by the literature review and findings from the methods, this chapter presents the Expanded Universal Design Guidelines and the projective design for Mammoth Hot Springs in Yellowstone National Park.

5.1 EXPANDED DESIGN GUIDELINES:

The documents that helped inform the development of the Expanded Design Guidelines include: ASLA's Universal Design Guide, The Principles of Universal Design (used in National Park Systems), Architectural Barriers Act, Americans with Disability Act, and other research that will be followed to create more inclusive designs.

The four categories that make up the Expanded Universal Design Guidelines are:

1. **Accessibility-** Examining the physical boundaries of the project.
2. **Enrichment-** Identifying the quality of the experience.
3. **Engagement-** Analyzing the involvement/participation of the user.
4. **Multi-Sensory-** Investigating the use of the 5 senses in designs, which will help to enhance the user's experience.

Each of these encompass multiple issues. There are two tiers of issues, required and recommended. The required portion lists elements that should be addressed for all universally designed projects, and the recommended portion lists aspects that may or may not work for each universally designed project.

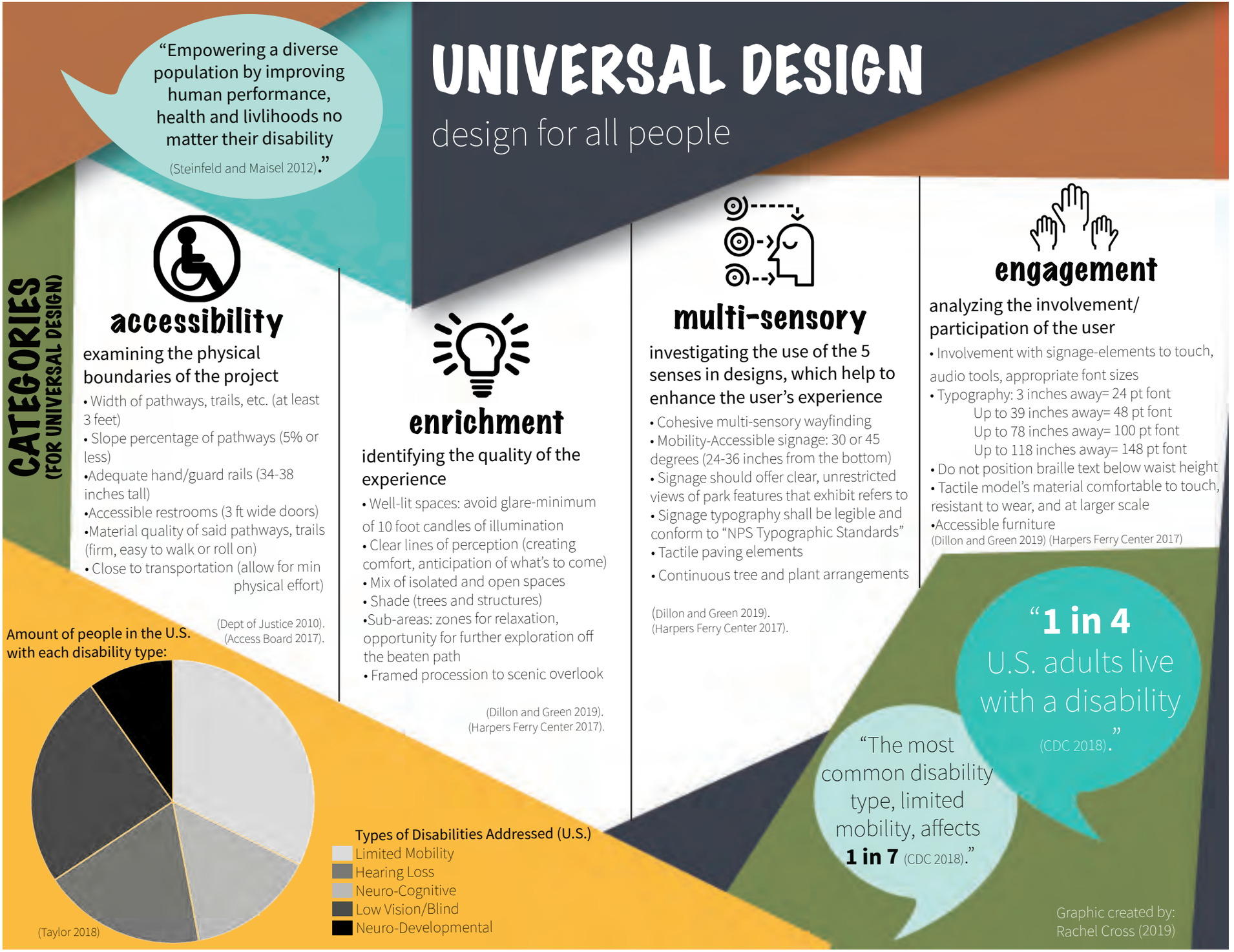


Figure 5.1: Universal Design Graphic (Cross 2019)

5.1.1 EXPANDED UNIVERSAL DESIGN GUIDELINES: ACCESSIBILITY:

Figure 5.2: Accessibility portion of Universal Design Graphic (Cross 2019)

Guidelines for accessibility carefully take into consideration the physical movement through a site. When designing for accessibility, designers should consider the following:

United States Access Board (ABA)

ADA AMERICANS WITH DISABILITIES ACT

INTERAGENCY VISITOR USE MANAGEMENT COUNCIL

American Society of Landscape Architects

NATIONAL PARK SERVICE

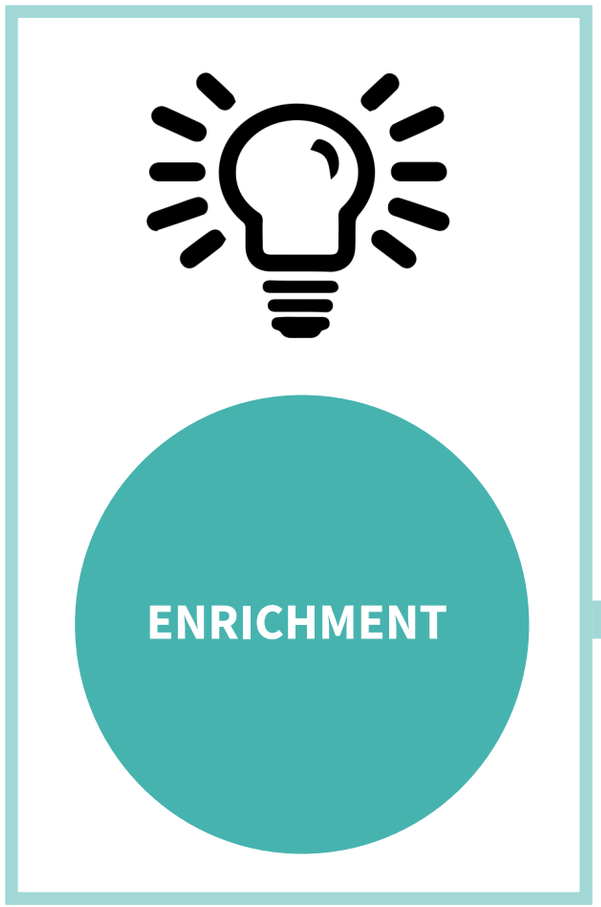
Required:

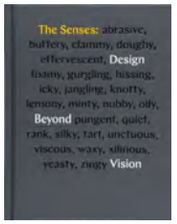
- Width of pathways, trails, etc. is at least 3 feet for single passage (United States Access Board 2018).
- Create wide enough paths to accommodate user's with other paces (Dillon and Green 2019).
- Slope percentage of pathways shall be less than 5.0% (United States Access Board 2018; Gostin 2015).
- Adequate hand/guard rails (34-38 inches tall) (United States Access Board 2018).
- Accessible restrooms (at least 3 foot wide door entry ways, accessible movement inside restrooms) (United States Access Board 2018).
- Material quality of pathways should be firm and not get warn easily (Dillon and Green 2019).

Recommended:

- Creation of accessible opportunities within the design to accommodate everyone (Dillon and Green 2019)
- Position key amenities close to transportation to allow for minimum physical comfort (Dillon and Green 2019; Interagency Visitor Use Management 2017)

5.1.2 EXPANDED UNIVERSAL DESIGN GUIDELINES: ENRICHMENT:





INTERAGENCY VISITOR USE MANAGEMENT COUNCIL

American Society of Landscape Architects

NATIONAL PARK SERVICE

Programmatic Accessibility Guidelines: Interpretive media

Guidelines for enrichment addresses the quality of experience for the user. When designing for enrichment, designers should consider the following:

Required:

- Avoid glare within the designed space, but add additional lighting to each space (Dillon and Green 2019) (Denver Service Center 2019).
- Create clear lines of perception in design (creating comfort, anticipation of what is to come). (Dillon and Green 2019; Green 2015)
- Incorporate overhead structures and vegetation for shade (Dillon and Green) (Marcus and Sachs 2014).
- Preserve the quality of the existing landscape as much as possible (Visitor Use Management 2019).

Recommended:

- Design a mix of isolated and open spaces (Green 2015).
- Sub-areas: zones for relaxation, smaller groups (Dillon and Green 2019)
- Sub-trails: opportunity for further exploration off the beaten path (Dillon and Green 2019)
- Framed procession to scenic overlook with use of existing vegetation (Dillon and Green 2019; Lupton and Lipps 2018)

Figure 5.3: Enrichment portion of Universal Design Graphic (Cross 2019)

5.1.3 EXPANDED UNIVERSAL DESIGN GUIDELINES: MULTI-SENSORY:

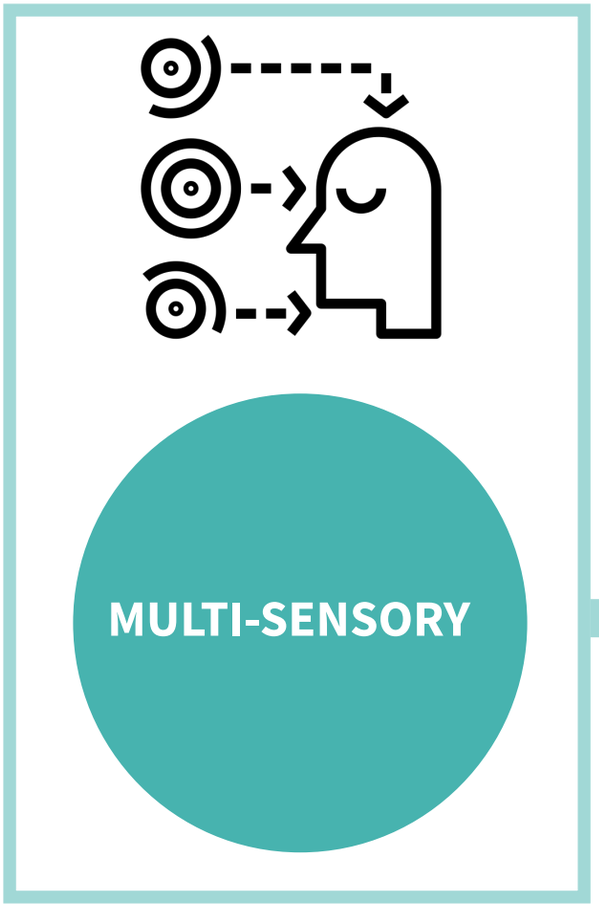
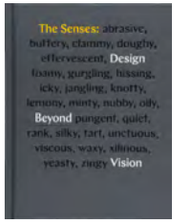


Figure 5.4: Muti-Sensory portion of Universal Design Graphic (Cross 2019)



American Society of Landscape Architects

NATIONAL PARK SERVICE

Programmatic Accessibility Guidelines: Interpretive media

Guidelines for multi-sensory carefully take into consideration the users experience through the use of the senses. When designing for multiple senses, designers should consider the following:

Required:

- Maintain cohesive multi-sensory wayfinding throughout site design (National Institute of Building Sciences 2019).
- Mobility- Accessible signage graphics: wayside exhibits angled 30 or 45 degrees, height of exhibit frame is 24-36 inches from the bottom (Harpers Ferry Center Accessibility Committee 2017).
- Signage should offer clear, unrestricted views of park features that exhibit refers to (National Park Service 2019)
- Signage typography shall be legible and conform to “NPS Typographic Standards” (Harpers Ferry Center Accessibility Committee 2017)

Recommended:

- Use different types of paving materials (Marcus and Sachs 2014; Dillon and Green 2019).
- Accessible signage graphics implemented through site design (Harpers Ferry Center Accessibility Committee 2017; Dillon and Green 2019)
- Interactive signage for touch and audio capabilities (Lupton and Lipps 2018)
- Interactive educational activities such as maps of site (Lupton and Lipps 2018; Dillon and Green 2019)

5.1.4 EXPANDED UNIVERSAL DESIGN GUIDELINES: ENGAGEMENT:

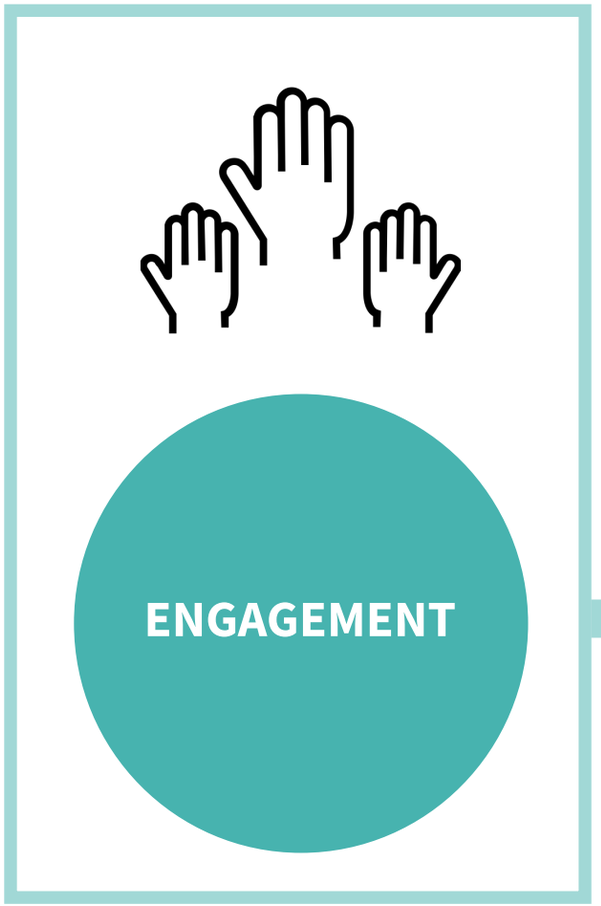
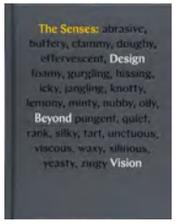


Figure 5.5: Engagement portion of Universal Design Graphic (Cross 2019)

Guidelines for engagement carefully take into consideration how users can learn more when at the site. When designing for engagement, designers should consider the following:

Programmatic Accessibility Guidelines: Interpretive media

American Society of Landscape Architects



United States Access Board (ABA)

Required:

- Provide opportunities to interact with signage through touch, audio, and size appropriate font (Harpers Ferry Center Accessibility Committee 2017).
- Typography- size varies based on distance of exhibit (Harpers Ferry Center Accessibility Committee 2017):
- Probable Viewing Distance:
  - 3” away= 24 pt. font
  - Up to 39” away= 48 pt. font
  - Up to 78” away= 100 pt. font
  - Up to 118” away= 148 pt. font
- Do not position braille text below waist height (Harpers Ferry Center Accessibility Committee 2017)
- Tactile models shall be of a material that is comfortable to touch, resistant to wear, and finished with a coating that allows for routine cleaning (Harpers Ferry Center Accessibility Committee 2017).
- Model may have to be larger scale to better understand (Harpers Ferry Center Accessibility Committee 2017)

Recommended:

- Provide exploration zones that take you off the main route of circulation (Dillon and Green 2019; Lupton and Lipps 2018).
- Accessible furniture (wheelchair friendly, storage for walkers/canes, armrests, seat backs) (Dillon and Green 2019; United States Access Board 2018)

5.2 PROJECTIVE DESIGN:

This chapter presents findings from the projective design, including: preliminary design concepts, the final design concept, enlargement areas of key design aspects, and a summary of how universal design can help specific disability types so that all can enjoy the site equally.

5.2.1 GOALS | OBJECTIVES | OUTCOMES:

Below is a table of the goals, objectives, and outcomes that the projective design achieves.

	Accessibility	Enrichment	Multi-Sensory	Engagement
Goals	• Create better accessibility for all people to use the site efficiently.	• Create a more cohesive space. Better circulation through site, and activities.	• Create educational opportunities in the site through multi-sensory components.	• Design is created to provide opportunities for all people no matter what disabilities they face.
Objectives	• Slope % of trails and paths. • Accessible connections and educational moments. • Accessible site furniture. • Accessible ground materiality. • Accessible connection and educational moments for all to enjoy. • Accessible signage.	• Re-evaluate site's circulation (what is working and what is not). • Open vs. isolated zones to create multiple types of experiences. • Important views around site are framed for intentional viewing. • Follow preservation factors of the site addressed in the Foundation Document.	• Interpretive Media in forms of signage, 3D elements, and educational zones. • Interpretive media will be designed to be accessible for a multi-sensory experience (hear, see, touch). • Use of multiple ground pavements will help the user to know where to step.	• Educational signage/activities for visitors to better understand the site • Redundant elements to create better way-finding elements in site. • Engage with the site in equal but different ways: highlighting researched disabilities: **Limited Mobility, Neuro-Cognitive and Neuro-Developmental impairments, Low Vision and Hearing**.
Outcomes	• The site becomes a destination where all people can make positive memories.	• Celebrating each area of the site in a different and unique way.	• A site that uses all of the senses in unique ways.	• Creating a design that leaves people knowing more about the site and how it came to be.

Table 5.0: Goals, Objectives, and Outcomes to guide the projective design. (Cross, 2020)

5.2.2 PRESERVATION CRITERIA:

The National Park Service (NPS) has created foundation documents for each park which addresses the main fundamentals resources, values, and visitor resources that will help to better preserve the landscape (National Park Service 2014). *Yellowstone's Foundation Document* was created to continue to protect the park and positively impact the visitor's experience. Specifically, the two fundamental values, Geothermal Wonders and A Park for the People: A "Wild" Experience, specifically highlight elements found in Mammoth Hot Springs that should be preserved. Below are the two components that physically from the document that impact the site at Mammoth Hot Springs.

Foundation Document: Yellowstone National Park

Fundamental Resources/Values related to site for projective design	Threats/Opportunities addressed:
Geothermal Wonders	**Threats:** • Development inside the park **(roads, parking areas, employee facilities, developed visitor sites)** may impact the above and below ground geothermal systems. • **Vandalism and disturbance** of thermal feature degrade the resource. • Erosion of fragile areas due to **social trails, trail placement** will degrade the resource. **Opportunities:** • **Avoid and mitigate** impacts of development to the extent possible. • Consider **removal** of some infrastructure in thermal areas to **reduce human-made impacts on geothermal systems** and restore systems that have already been impacted. • Continue to **educate visitors** about the dynamic nature of geothermal systems. • Use **trail reroutes** and other actions to protect geothermal features and visitors.
A Park for the People: A "Wild" Experience	**Threats:** • **Congestion** occurs throughout the park during the summer regarding commercial services, campgrounds, parking areas, traffic, etc. • **Human-wildlife interactions** result in traffic congestion and safety concerns, trail safety concerns, and conflicts along roadsides. • Park **infrastructure is aging** and may fail, including historic resources. • Climate change may influence park visitation patterns and activities, affecting park operations and budgets. **Opportunities:** • Improve **entry sequences** into park features and **enhance pedestrian and vehicular circulation.** • Provide for **accessibility and universal design.** • Improve **communication of research results** to educate the public. • **Improve visitor safety and appropriate management,** while providing a desired visitor experience and protecting resources.

Table 5.1: Preservation guidelines from Yellowstone's Foundation document. (Cross, 2020; NPS (12) 2014)

5.2.2.1 SITE DESIGN SUITABILITY:

Based on the foundation document for Yellowstone, figure 5.7 diagrams the primary and secondary zones that should be preserved. The primary zones are the terraces/spring locations. These zones should not have any infrastructure built on them. The secondary zones are portions of the flow, and where calcium carbonate runs off from springs and begins to form. In these zones, infrastructure can be added, but it is important to be aware of where existing infrastructure is located and build off of those specific areas before disturbing other areas. The last zone that should be protected as much as possible is the only zone with the vegetation on the site. Because this site is so unique, due to its geomorphology, this part of the site is unique. It is important to have a relationship between preservation of the site and designing the site through a universal design lens.

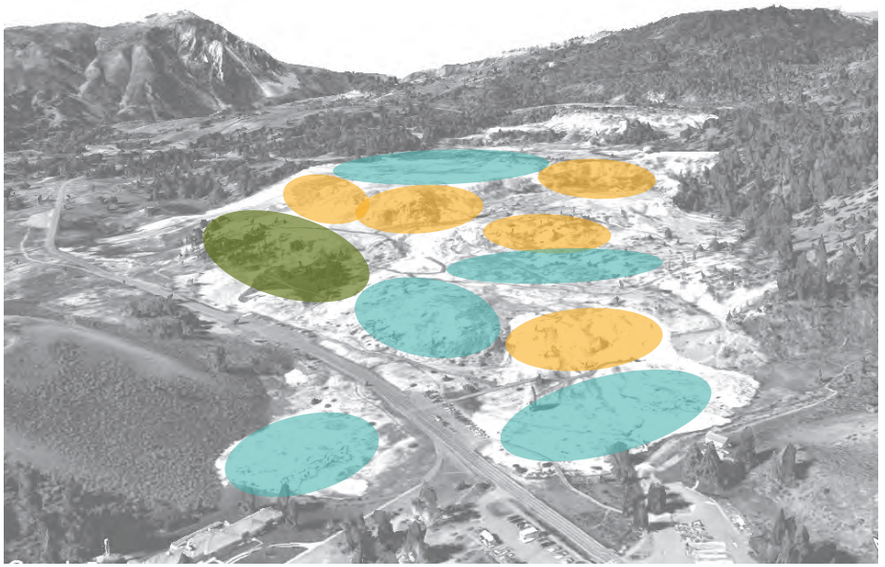


Figure 5.7: Primary, Secondary, and Vegetated Zones are shown as to how preservation criteria plays a role in the design. (Cross, 2020)(NPS (12) 2014)

5.2.3 PRELIMINARY DESIGN CONCEPTS:

To test different circulation strategies and to apply the Expanded Universal Design Guidelines, two preliminary design concepts were created. Each design was guided by the goals and objectives stated in 5.2.1 and then evaluated by its strengths and weaknesses in order to determine viability for certain aspects. Positive aspects from the preliminary concepts help to inform the final projective site design.

5.2.3.1 CONCEPT 1:

In the first concept, the goal is to focus on the entries of the site that invite people in. Some of the main opportunities of this concept are:

- The circulation of this design has specific visual axis points to the different spring/ terraces throughout the site.
- Nodes are designed for users to get off the main trails to learn more about the site through interpretive media displays.
- These nodes are designed to preserve the site/ showcase views found here.
- The disability types that were previously researched are highlighted in a positive way through the designs of the enlargements.

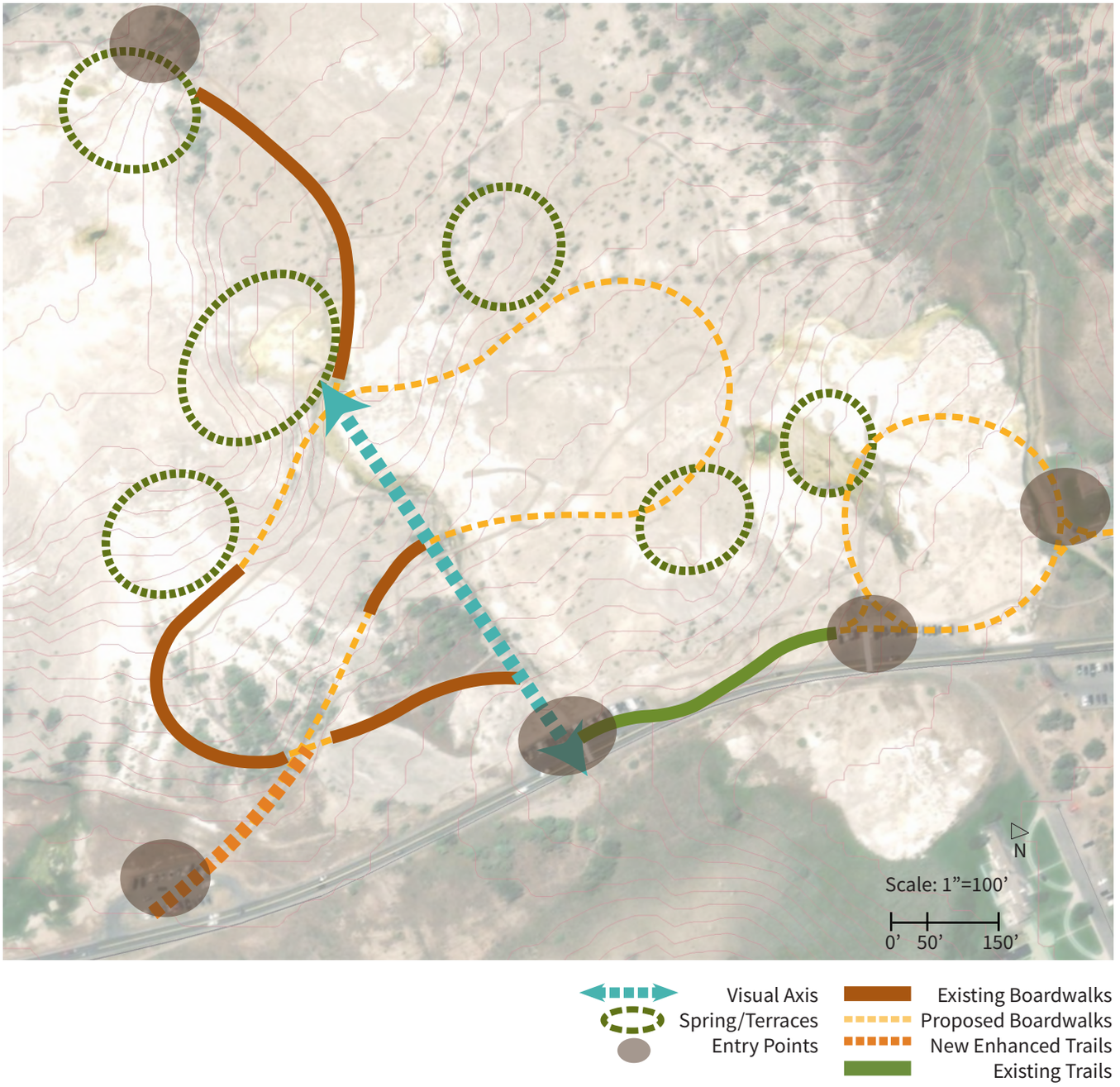


Figure 5.8: Plan view of concept 1 design (Cross 2020)

5.2.3.2 CONCEPT 1: HYMEN TERRACE: LIBERTY CAP ENTRY ZONE AREA:

For concept 1, the Hymen Terrace: Liberty Cap Enlargement is the entry zone of the design. This geometry type was chosen to enhance the view points of the visitor's experience. Each component of this design was thought out based on prior research done. Universal design components are used to create an inclusive site for a broader user audience.

- **Limited Mobility:** experience the site with 5% slopes or less, handrails installed all the way through site, all surfaces made with sturdy material.
- **Neuro-Cognitive Impairments**: clear circulation throughout site, circular path shows clear entries.
- **Neuro-Developmental:** bump out zones that are clearly defined, closer to attractions surrounding the site.
- **Hearing Loss:** wayfinding resources (signage), fluid circulation through geometry and different ground materiality.
- **Vision Loss:** no barriers in the way, signage zones will have different ground materiality to suggest there is a new zone, color distinctions between materials for better clarity.

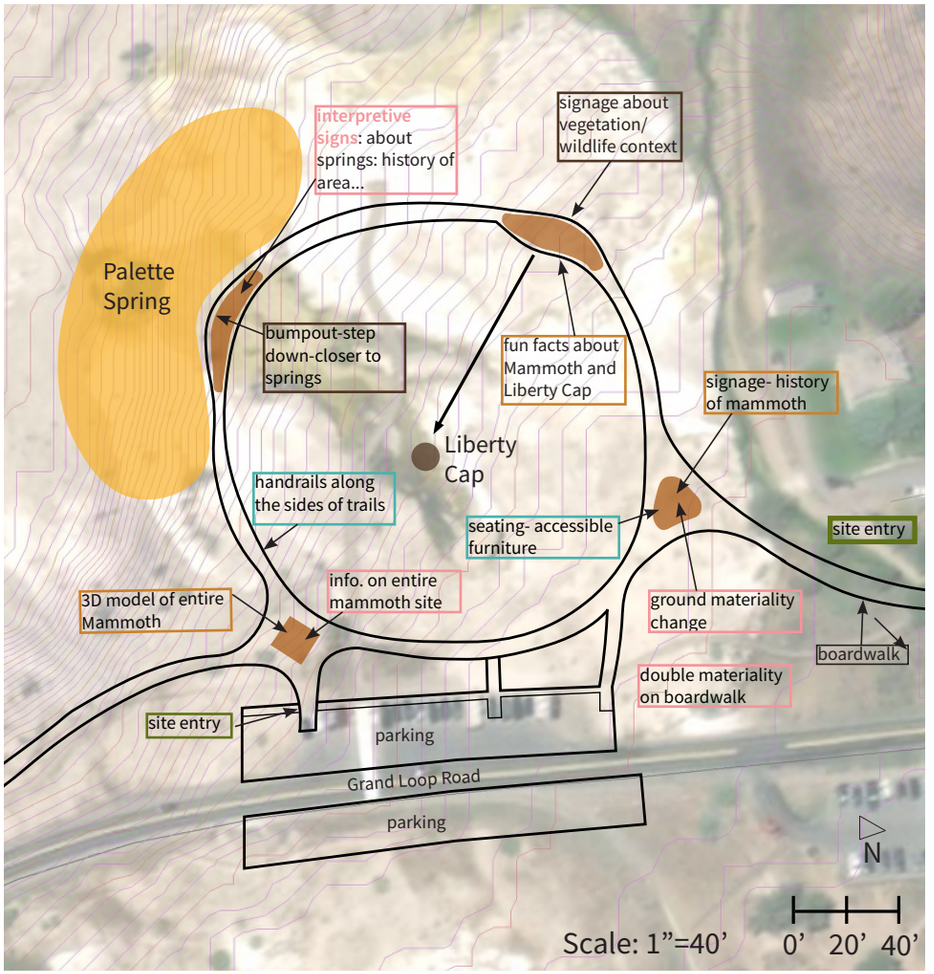


Figure 5.9: Plan view of Hymen Terrace Enlargement. (Cross 2020)

5.2.3.3 CONCEPT 1: REFLECTION ZONE ENLARGEMENT:

The reflection zone is a secondary portion of the design that highlights a secondary trail for people to enjoy. The goal of this area is to create a quieter space through smaller paths and signage that will allow the user to learn and experience the site with less people surrounding them. Below, lists inclusive opportunities for a boarder usser audience.

- **Limited mobility:** experience the site with 5% slopes or less, handrails installed all the way through site, all surfaces made with sturdy material.
- **Neuro-Cognitive Impairments:** clear circulation throughout site, redundant signage
- **Neuro-Developmental:** bump out zones that are clearly defined, learning elements to engage with.
- **Hearing Loss:** wayfinding resources (signage), fluid circulation through geometry and different ground materiality, interpretive media.
- **Vision Loss:** no barriers in the way, signage zones will have different ground materiality to suggest there is a new zone, color distinctions between materials for better clarity.

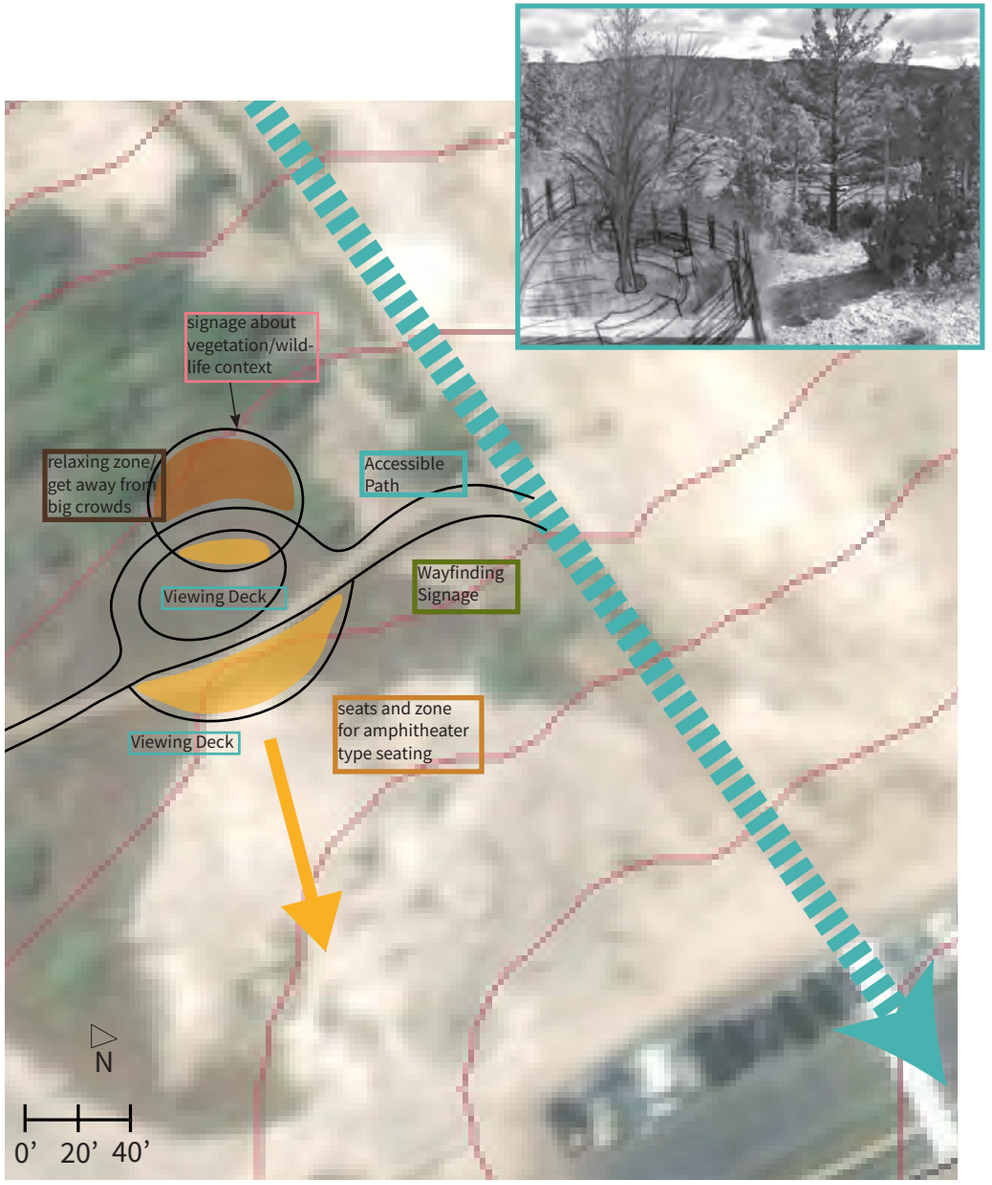


Figure 5.10: Plan view of Reflection Zone enlargement. (Cross 2020)

5.2.3.4 OBJECTIVES ADDRESSED IN CONCEPT 1:

Concept 1 focused more on the preservation of the site to see how the existing circulation could benefit from new circulation connections that would be provided. Although many existing paths were used, some of the secondary zones for preservation would be harmed, with the path circulation lacking cohesive routes. Lastly, the use of specific nodes was helpful in achieving the objectives for educational/signage zones and creating unique opportunities for each highlighted disability type.

	Accessibility	Enrichment	Multi-Sensory	Engagement
Goals	• Create better accessibility for all people to use the site efficiently.	• Create a more cohesive space. Better circulation through site, and activities.	• Create educational opportunities in the site through multi-sensory components.	• Design is created to provide opportunities for all people no matter what disabilities they face.
Objectives	• Slope % of trails and paths. • Accessible connections and educational moments. • Accessible site furniture. • Accessible ground materiality. • Accessible connection and educational moments for all to enjoy. • Accessible signage.	• Re-evaluate site's circulation (what is working and what is not). • Open vs. isolated zones to create multiple types of experiences. • Important views around site are framed for intentional viewing. • Follow preservation factors of the site addressed in the Foundation Document.	• Interpretive Media in forms of signage, 3D elements, and educational zones. • Interpretive media will be designed to be accessible for a multi-sensory experience (hear, see, touch). • Use of multiple ground pavements will help the user to know where to step.	• Educational signage/activities for visitors to better understand the site • Redundant elements to create better way-finding elements in site. • Engage with the site in equal but different ways: highlighting researched disabilities: **Limited Mobility, Neuro-Cognitive and Neuro-Developmental impairments, Low Vision and Hearing**.
Outcomes	• The site becomes a destination where all people can make positive memories.	• Celebrating each area of the site in a different and unique way.	• A site that uses all of the senses in unique ways.	• Creating a design that leaves people knowing more about the site and how it came to be.

5.2.4 CONCEPT 2:

In the second concept, the goal of this design is to move the user throughout the site and see each terrace/spring. Some of the main opportunities for this concept are:

- Trail system provides jaunts by each of the terraces/springs.
- Trail system provides not only views inward (towards terraces/springs) but also views outward.
- Zones where trail is larger (around terraces/springs).
- Site circulation showcases views outward with how pathways are designed.
- Educational zones along trail system-interpretive media, seating zones.

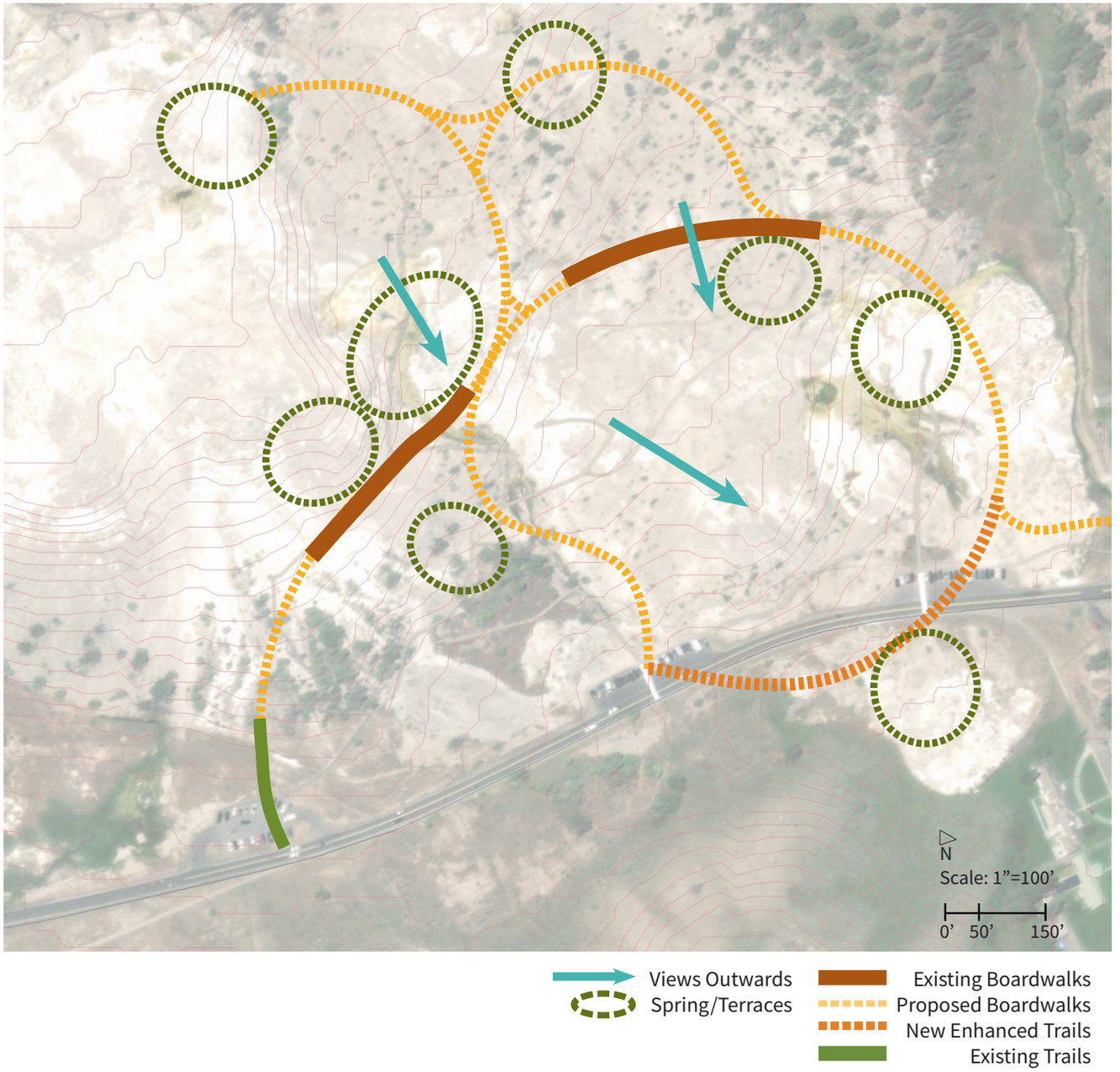


Figure 5.11: Plan view of concept 2 design (Cross 2020)

5.2.4.1 CONCEPT 2: HYMEN TERRACE: LIBERTY CAP ENLARGEMENT AREA:

The overall idea for Concept 2 highlights the connected circulation route. The idea is to create a seamless path which will connect all major terraces/springs in one general swoop. Below, lists how each highlighted disability type would be able to experience the space in a unique and equal way.

- **Limited mobility:** experience the site with 5% slopes or less, handrails installed all the way through site, all surfaces made with sturdy material.
- **Neuro-Cognitive Impairments:** clear circulation throughout site, redundant signage
- **Neuro-Developmental:** enlarged parts of main trail system, learning elements to engage with.
- **Hearing Loss:** fluid circulation through geometry and different ground materiality, interpretive media.
- **Vision Loss:** signage and sitting areas are clearly defined by new ground pavement.

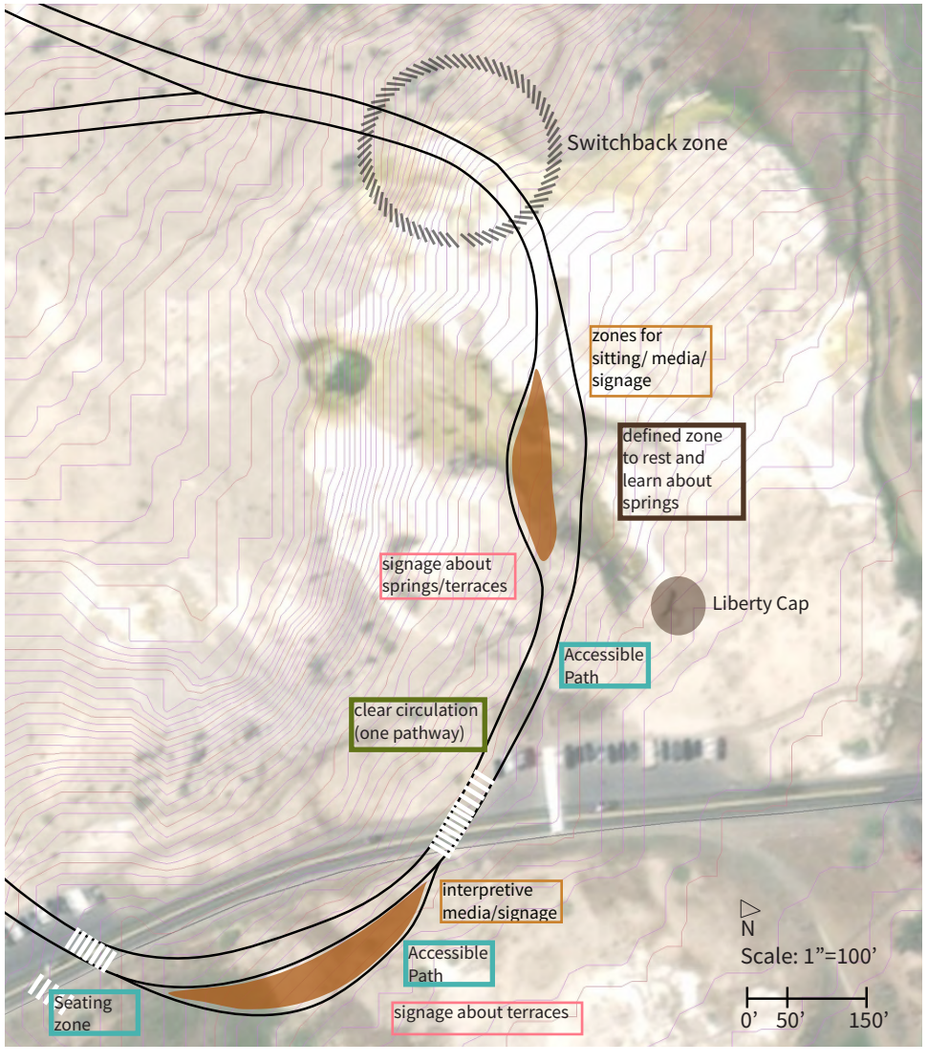


Figure 5.12: Plan view of Jupiter Terrace. (Cross 2020)

5.2.4.2 CONCEPT 2: MINERVA TERRACE ENLARGEMENT AREA:

This enlargement shows how Concept 2 has educational/ viewing opportunities connected to the main circulation of the site. From this zone, each highlighted disability is highlighted.

- **Limited mobility:** experience the site with 5% slopes or less, handrails installed all the way through site, all surfaces made with sturdy material.
- **Neuro-Cognitive Impairments:** clear circulation throughout site (can see what is in front of them).
- **Neuro-Developmental:** enlarged zones of trail to get off main path.
- **Hearing Loss:** wayfinding resources (signage), fluid circulation through geometry and different ground materiality, interpretive media.
- **Vision Loss:** no barriers in the way, signage zones will have different ground materiality to suggest there is a new zone.

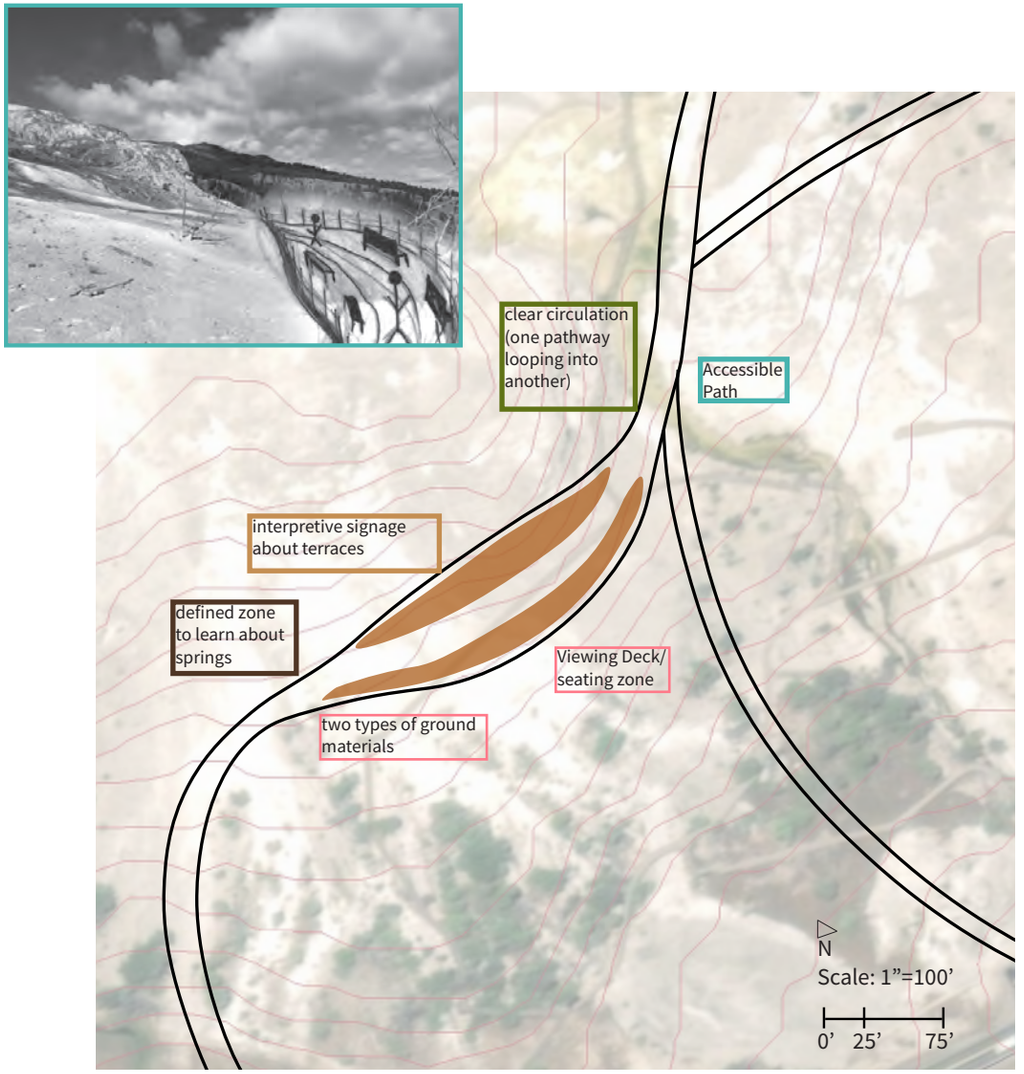


Figure 5.13: Plan view of Minerva Terrace. (Cross 2020)

5.2.4.3 OBJECTIVES ADDRESSED IN CONCEPT 2:

Concept 2 focuses specifically on the circulation through the site for the pedestrian to walk by all the terraces/springs. With new proposed circulation, the design lacks to fully follow the preservation factors that are addressed in Yellowstone's Foundation Document. With the trail system being one continuous system, there are no secondary zones, which takes away from the idea of creating spaces to get away. Also, this site focuses on outward views and doesn't worry as much about the entries. The goal behind this idea is to create a cohesive circulation that will bring the user into the site.

	Accessibility	Enrichment	Multi-Sensory	Engagement
Goals	• Create better accessibility for all people to use the site efficiently.	• Create a more cohesive space. Better circulation through site, and activities.	• Create educational opportunities in the site through multi-sensory components.	• Design is created to provide opportunities for all people no matter what disabilities they face.
Objectives	• Slope % of trails and paths. • Accessible connections and educational moments. • Accessible site furniture. • Accessible ground materiality. • Accessible connection and educational moments for all to enjoy. • Accessible signage.	• Re-evaluate site's circulation (what is working and what is not). • Open vs. isolated zones to create multiple types of experiences. • Important views around site are framed for intentional viewing. • Follow preservation factors of the site addressed in the Foundation Document.	• Interpretive Media in forms of signage, 3D elements, and educational zones. • Interpretive media will be designed to be accessible for a multi-sensory experience (hear, see, touch). • Use of multiple ground pavements will help the user to know where to step.	• Educational signage/activities for visitors to better understand the site • Redundant elements to create better way-finding elements in site. • Engage with the site in equal but different ways: highlighting researched disabilities: **Limited Mobility, Neuro-Cognitive and Neuro-Developmental impairments, Low Vision and Hearing**.
Outcomes	• The site becomes a destination where all people can make positive memories.	• Celebrating each area of the site in a different and unique way.	• A site that uses all of the senses in unique ways.	• Creating a design that leaves people knowing more about the site and how it came to be.

5.2.5 FINAL DESIGN:

Through multiple iterations, examining existing preservation laws addressed in table 5.1, and achieving the goals, objectives, and outcomes found in table 5.0, Figure 5.15 is the final design for Mammoth Hot Springs in Yellowstone National Park. The concept of this final design was make a more complete and accessible circulation system. The goal of this design was to preserve as many trails as possible, but also to manage and maintain them to give people a more fulfilling experience. This design is complete with 4 parking zones, multiple ADA parking, 4 accessible entries into the park, bump-out zones to get the user closer to the terraces/springs without harming them, secondary zones that are off the main trail system, and opportunities for the visitor to learn more about the site.

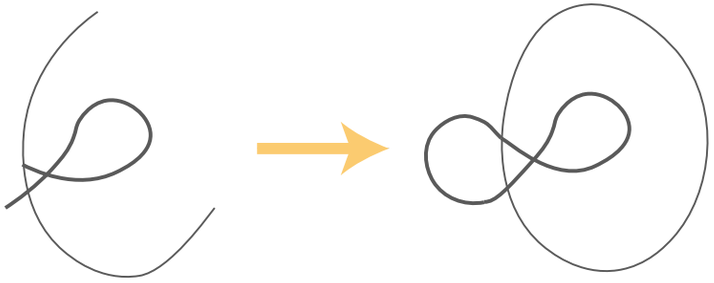
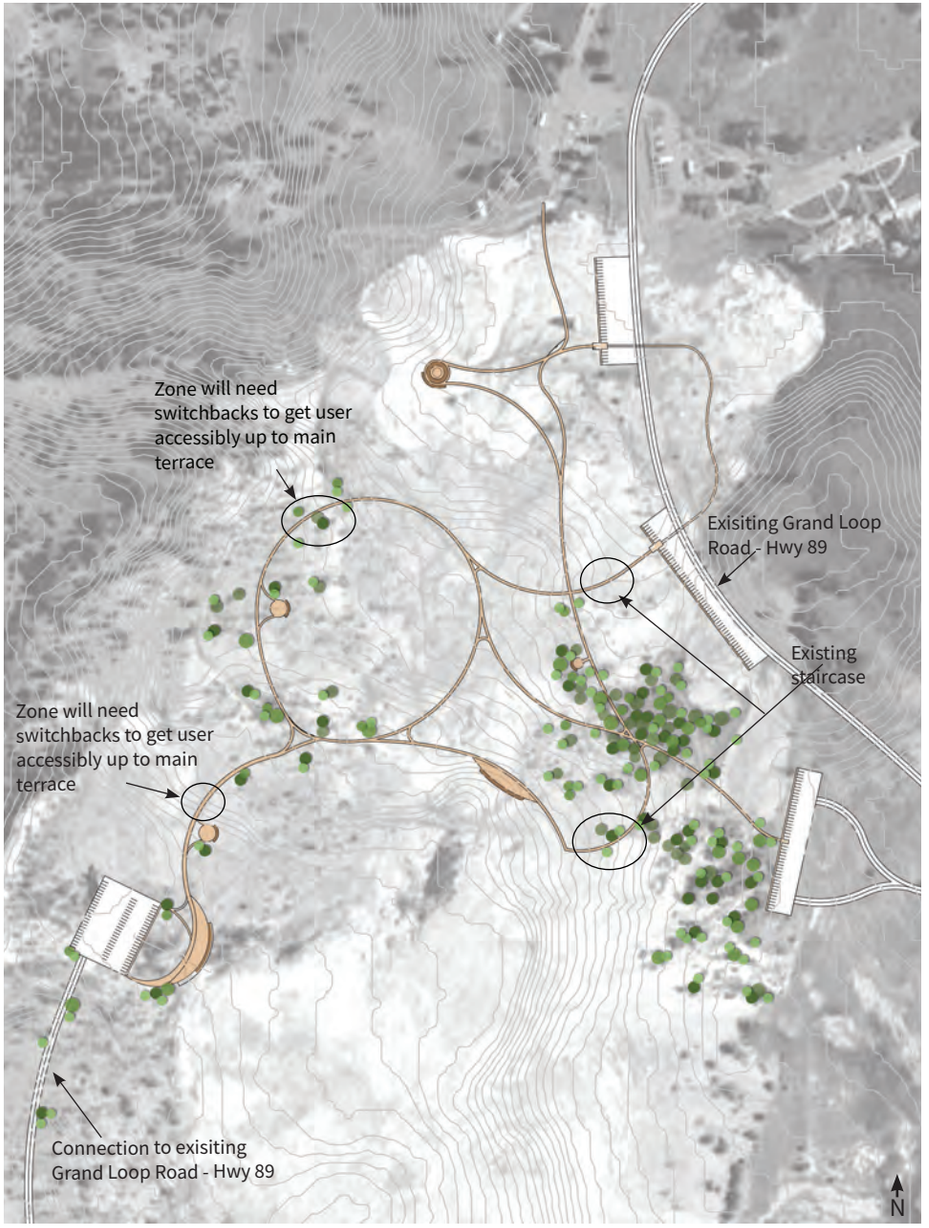


Figure 5.14: Concept Diagram of Site Design. (Cross 2020)



Scale: 1”=100’

Figure 5.15: Plan view of new design at Mammoth Hot Springs. (Cross 2020)

5.2.5.1 EXISTING VS. PROPOSED SITE CIRCULATION:

The site's existing circulation is composed of both accessible and not accessible pathways and parking lots. In Figure 5.16, the accessible parking lots and pathways are highlighted in brown. The non-accessible pathways/ parking lots are highlighted in black. The existing infrastructure is practical for an abled bodied individual, but does not take into count those who may have a disability type which would limit them to experience the site in an equal way. The new circulation looks at the issues at hand and addresses them in a new circulation that does not completely stray away from what is existing.

The proposed circulation takes a look at the existing circulation and is modified to meet the needs of a bigger population of people who will visit the site. More parking spots are added to the site, 3 out of the 4 parking zones connected to the site have accessible parking options, the new circulation of the trails are more accessible, there are more opportunities for educational experiences, and more space for each user to fully enjoy the site. Highlighted in brown are the accessible trails/zones of the proposed circulation. Highlighted in black is the non-accessible trails of the proposed circulation. Circulation would have to be considered further evaluation with the need for stairs and switchbacks for accessibility purposes.

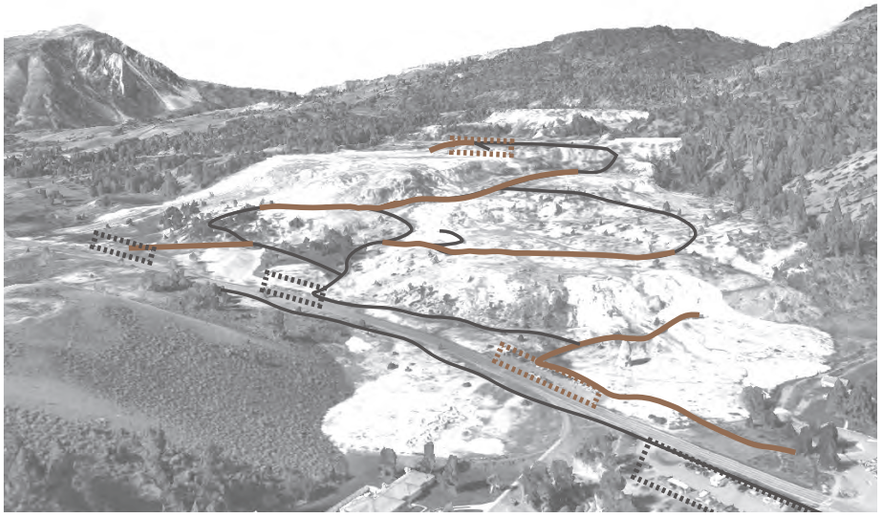


Figure 5.16: **Existing** pedestrian/vehicular circulation at Mammoth Hot Springs. (Cross 2020)

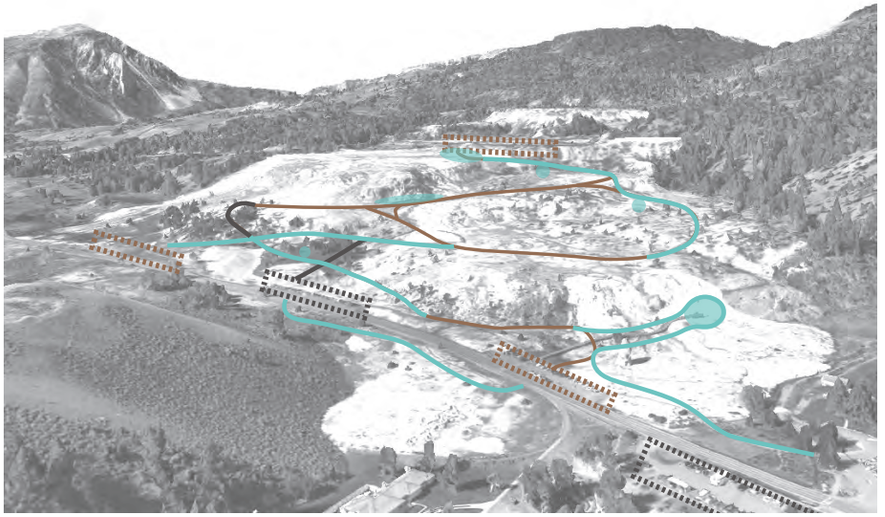


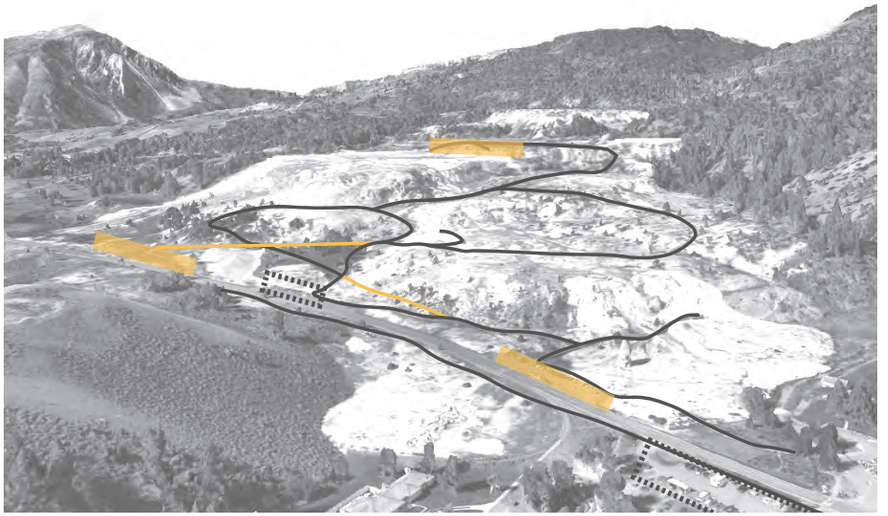
Figure 5.17: New pedestrian/vehicular circulation at Mammoth Hot Springs. (Cross 2020)

5.2.5.2 PHASING:

Phasing shows the priorities of the design, and how to efficiently build and install each component in a timely manner. This projective design is composed of 3 different phases, which will be more fully discussed below. Each phase is highlighted in yellow.

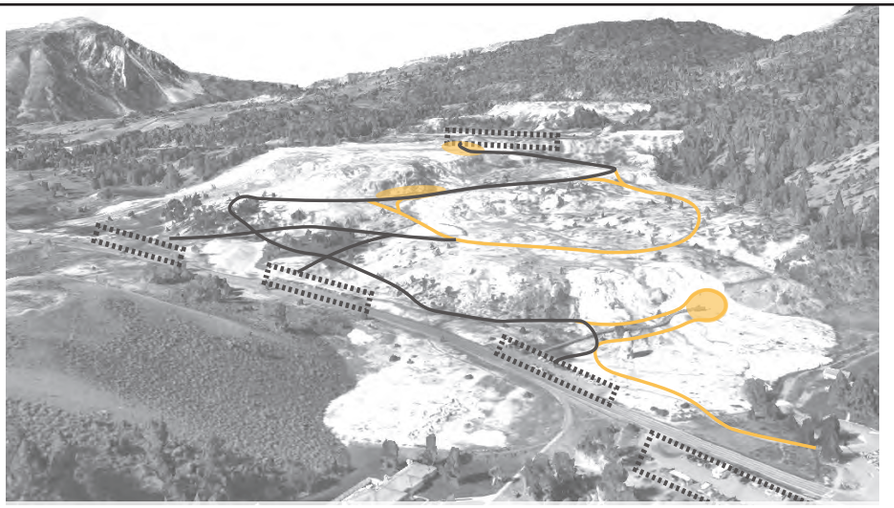
PHASE 1:

- Add parking/accessible parking: over double the number of existing parking spots will be added to the site to help with congested vehicular circulation.
- Add accessible boardwalks to areas where people can't get to for equal access.
- Connect new boardwalks to existing boardwalks.



PHASE 2:

- Add new primary educational zones.
- Modify new circulation routes in Hymen Terrace.
- Update boardwalks that are surrounding the primary educational zones.
- Add educational seating and signage to primary zones.



PHASE 3:

- Add secondary educational zones.
- Update existing boardwalks to create a more connected circulation unit.
- Add educational seating and signage to secondary zones.
- Connect any other existing linkages to proposed to midigate dead end paths.
- Take out paths that are random.

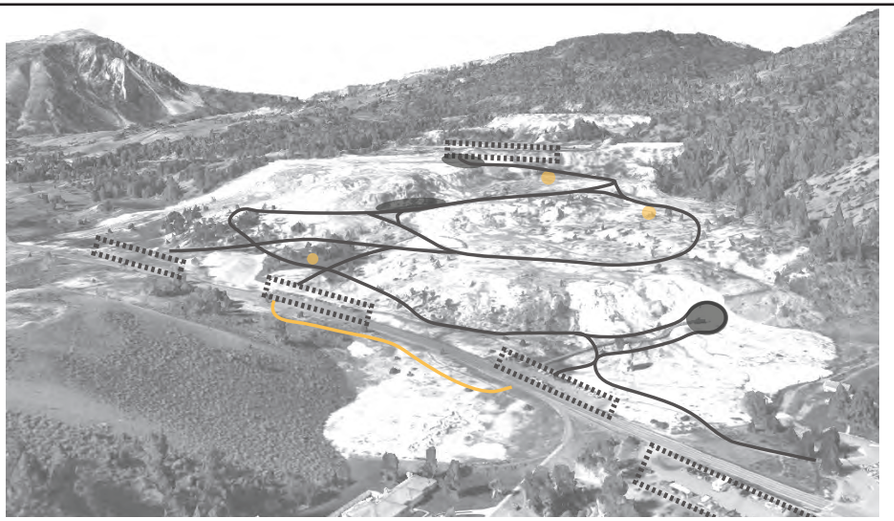
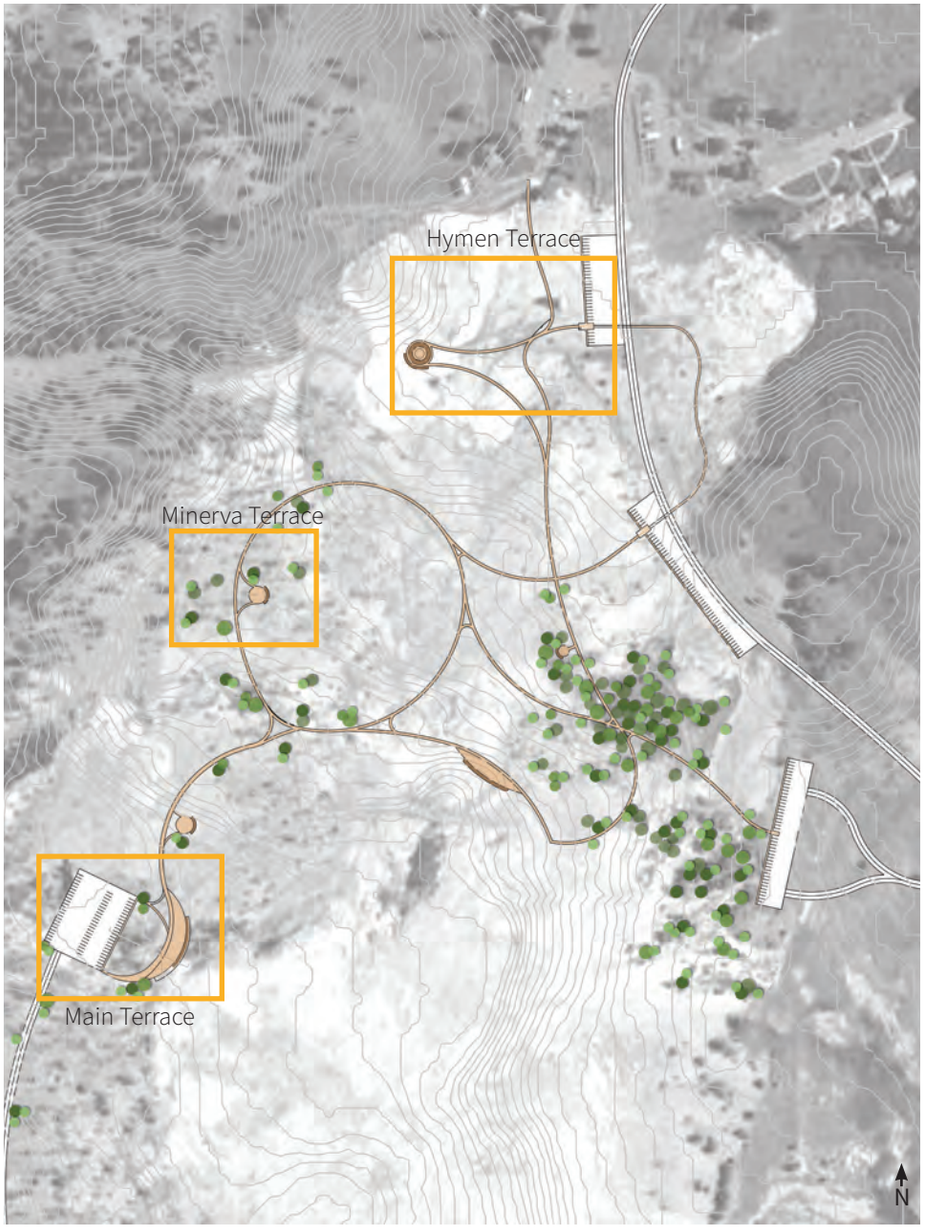


Figure 5.18: Phases of design. (Cross 2020)

5.2.5.3 PLAN ENLARGEMENTS AREAS:

To illustrate key aspects of the final design, three enlargement areas are used to show the proposed trail system and highlight the proposed educational/lookout zone in the Hymen Terrace with views to Palette Springs; a proposed viewing deck at the Minerva Terrace; and, the Main Terrace deck connects directly to an ADA parking lot.



Scale: 1”=100’

Figure 5.19: Enlargement call outs of new design at Mammoth Hot Springs. (Cross 2020)

HYMEN TERRACE

The design at Hymen Terrace brings users into the site from the northern most existing parking lot and newly designed parking. The wide paths allow users to go at their own pace, while enjoying specific portions of the site. The circular terminus allows for people to sit and read more about the site, get closer to the terraces/springs along the bump out. There are educational spaces to sit and enjoy learning more about the history of the site.

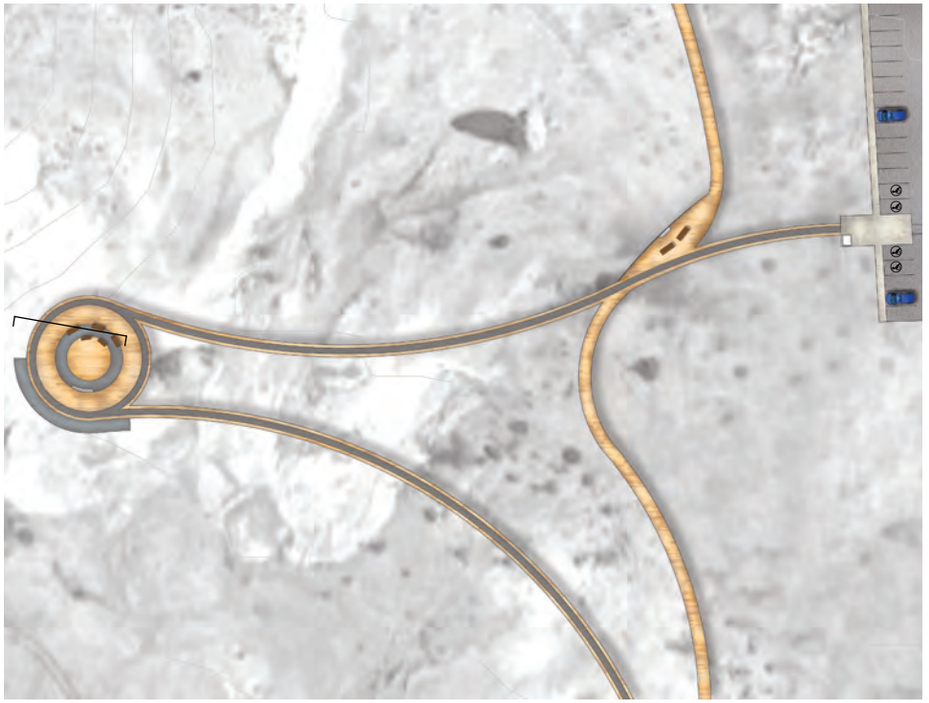


Figure 5.20: Plan of Hymen Terrace enlargement. (Cross 2020)

Figure 5.21: Section of Hymen Terrace enlargement. (Cross 2020)

MINERVA TERRACE

The enlargement for the bump-out zone in the Minerva Terrace is considered a secondary zone of the site design. This secondary zone is located in a more vegetated area along the site's outer perimeter, which creates a more secluded, unique experience. This area was positioned to highlight views across the site, as well to accommodate small groups. The section-cut in Figure 5.23 shows where one can sit and learn more within this zone in the Minerva Terrace.

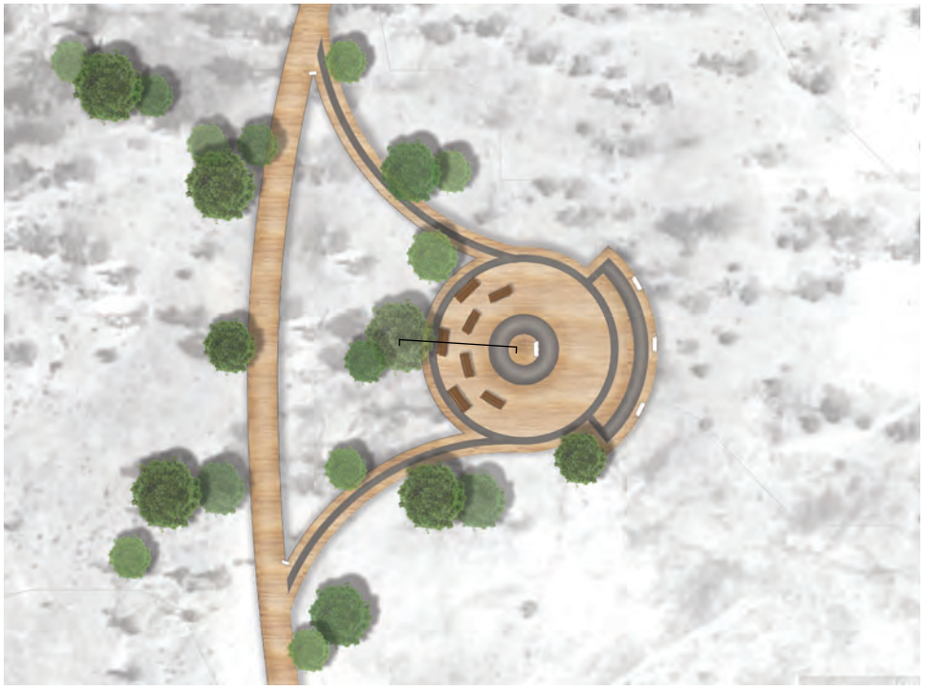


Figure 5.22: Plan of Minerva Terrace enlargement. (Cross 2020)

Figure 5.23: Section of enlargement. (Cross 2020)

MAIN TERRACE

The Main Terrace was designed for the user to see views of the Main Terrace, and extended views to the north and east of the site. This area is also connected to a fully accessible parking lot with over 25 ADA parking spots. The new board walk circulation creates ease for visitors to use this new overlook or to continue into the site. This boardwalk is equipped with a two tiered viewing deck, multiple seating zones, multiple opportunities for educational purposes and learning about the history/more about the site. The section in Figure 5.25 shows the main circulation (pathway) and how it is connected to the two viewing tiers.

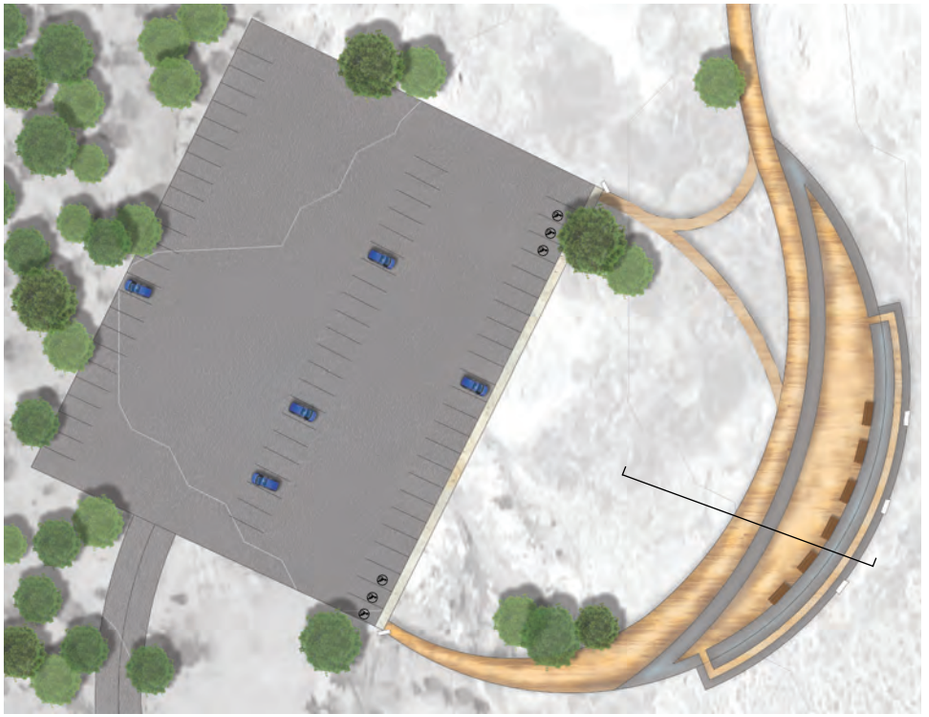


Figure 5.24: Plan of Main Terrace enlargement. (Cross 2020)

Figure 5.25: Section of Main Terrace enlargement. (Cross 2020)

5.2.5.4 UNIVERSAL DESIGN GUIDELINES APPLIED THROUGH PROJECTIVE DESIGN:

The Expanded Universal Design Guidelines illustrate how designed spaces can be inclusive for all, especially for those who live with a disability. To be truly inclusive, it is important to consider the nuanced needs associated with the five most common disability types: Limited Mobility, Neuro-Cognitive, Neuro-Developmental, Low Hearing, and Low Vision. The following section shows how the projective design applied guidelines for each disability.

Figure 5.26: Existing View of the Main Terrace (the top portion of the site)(Cross 2020)

LIMITED MOBILITY

Figure 5.26 shows an existing view of the Main Terrace at Mammoth Hot Springs. Figure 5.27 shows the newly designed space, looking the opposite direction at the Main Terrace. For this specific area, those with limited mobility can efficiently use this newly designed space in an equal manner by:

- Installing boardwalks and ramps with a 5% slope or less
- Direct connection to accessible vehicular parking.
- Wide pathways- over 3 feet for more than one person to walk side by side
- Accessible signage
- Adequate hand/guard rails (34-38 inches tall)
- Proper material surface on boardwalks/paths: metal guards and wood
- Accessible seating options (benches with arm rest and backs)

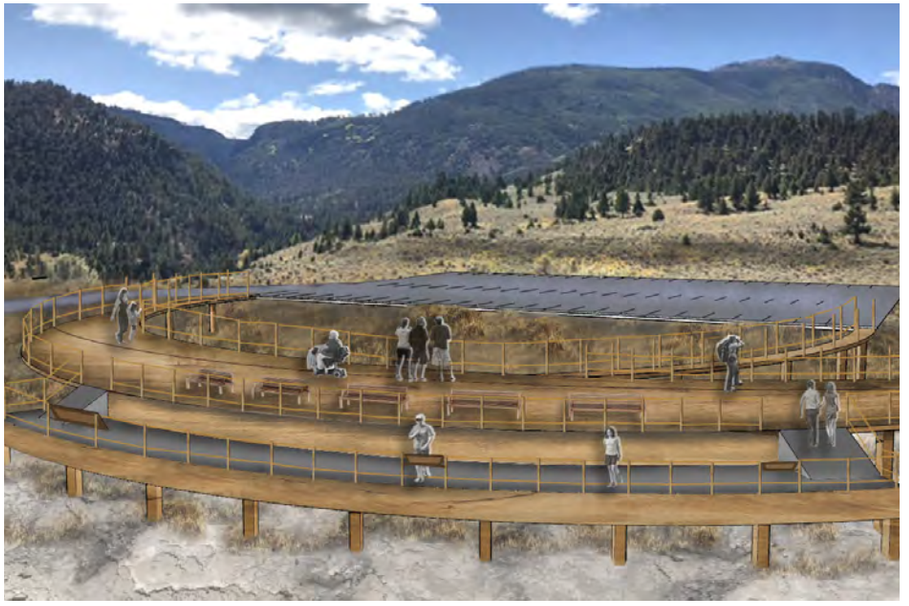


Figure 5.27: Perspective view highlighting how the projective design can create new opportunities for those with limited mobility. (Cross 2020)

NEURO-COGNITIVE DISORDERS

Figure 5.28 a portion of Minerva Terrace, facing east, where there is some vegetation growth. Figure 5.29 shows a newly designed secondary space at the Minerva Terrace. At the Minerva Terrace, those with neuro-cognitive disorders can efficiently use the newly designed space in an equal manner from:

- Clearly designed entry ways
- Creating specific zones for certain elements, such as a viewing area and educational area
- Most shaded zone on site provides respite to avoid overheating
- Clear sightlines across the site can create enhanced feelings of safety

Figure 5.28: View of existing location where secondary zone will be. (Cross 2020)

Figure 5.29: Perspective View showing secondary zone on the edge of the Minerva Terrace. (Cross, 2020)

NEURO-DEVELOPMENTAL IMPAIRMENTS

Figure 5.30 is an existing view of a part of Minerva Terrace, closely connected to Jupiter Terrace. Figure 5.31 shows a new bump-out zone where visitors can get closer to the formations. Those with neuro-developmental impairments can efficiently use this newly designed space due to:

- Smooth transitions between each space
- Zones for certain elements, such as a viewing area, educational area, and seating
- Signage with 3D elements for visitors to touch and learn about the site

Figure 5.30: Existing view of the Minerva Terrace and the existing trail system. (Cross 2020)

Figure 5.31: Perspective View of newly designed Minerva Terrace bumpout. (Cross 2020)

HEARING LOSS

Figure 5.32 is an existing view of Hymen Terrace. Figure 5.33 shows the new design for Hymen Terrace. Those with hearing loss can efficiently use this newly designed space in an equal and enjoyable manner from:

- Two types of ground materials: wood in main pathways and metal in viewing deck and circular educational zone
- Unobstructed main circulation
- Seating is located in areas of designated zones, offset from main circulation
- Wooden supports along each side of boardwalk so there is no way one would slip off edge

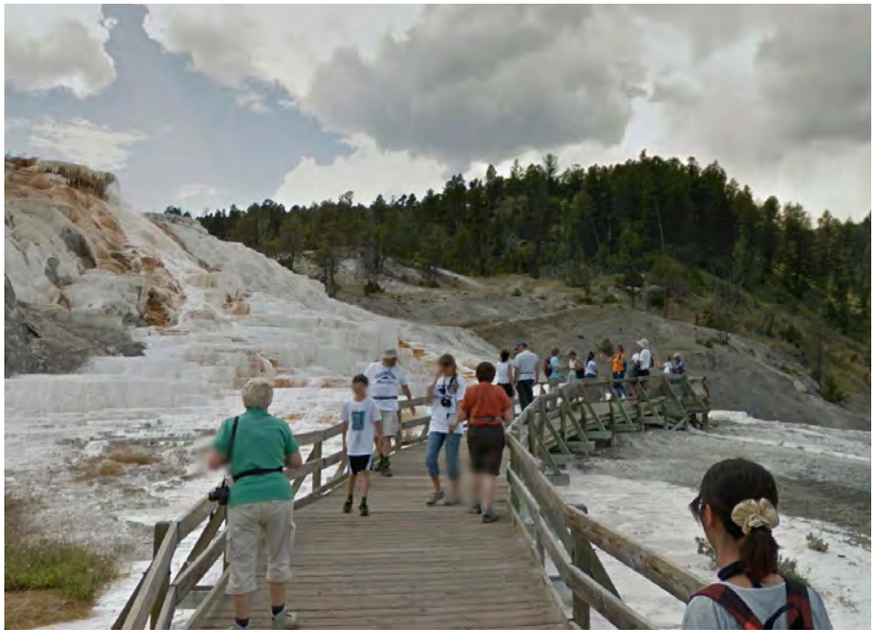


Figure 5.32: Existing view of the entry into the site at Hymen Terrace in Mammoth Hot Springs. (Cross 2020)

Figure 5.33: Perspective view showing how interpretive media can impact those with hearing loss. (Cross 2020)

LOW VISION

Figure 5.34 is a view of the entry at Hymen Terrace. Figure 5.35 shows the new entry for Hymen Terrace. Those with low vision can efficiently use this newly designed space in an equal and enjoyable manner from:

- Wood materiality of main pathway would be a lighter stain and wood on the edges of boardwalk would be darker stain
- Wide boardwalks (8 feet wide) to minimize collisions with other pedestrians
- Unobstructed main circulation
- Seating is located in areas in designated zones, offset from main circulation
- Barriers connected to bottom of handrails for user to know where edge of boardwalk is

Figure 5.34: **Existing** view showing the circulation of Hymen Terrace to the Palette Springs.(Cross 2020)

Figure 5.35**: Proposed** perspective view of new entry into Hymen Terrace. (Cross 2020)

Figure 6.0: Main Terrace View (Cross, 2019)

CHAPTER 6:
Conclusion

6. PROJECT SUMMARY:

As this report comes to a close, it is important to reflect on what its findings mean to the author, the field of Landscape Architecture, and universal design. Universal design is an important, emerging practice that strives to create inclusive experiences for every person who visits a place, no matter their abilities. This report examined acts and guidelines currently used to inform the design of inclusive spaces, finding key gaps. The new guidelines were then applied to the projective design for Mammoth Hot Springs in Yellowstone National Park. The projective design illustrated new possibilities for amenities to support accessibility, enrichment, engagement, and multi-sensory elements, thus creating a more inclusive and immersive site experience. Although many aspects of universal design can be achieved in a site design, there are unique challenges that designers must address for each project.

6.1 CHALLENGES TO INCORPORATING UNIVERSAL DESIGN STRATEGIES:

Each project site inherently has different conditions, like context, client, budget, design program, and intended users. Regardless of site nuances, designers should always strive to consider different disability types and opportunities to support a more inclusive experience for all. However, some elements that would positively support the experience of persons with one disability may negatively affect persons with other disabilities. For example, elements for those with low hearing like multi-use spaces, may trigger those with neuro-devolopmental impairments in a negative way. It is important to know the user group that you are designing for and how they may react to specific aspects within the design.

Universal design looks at both the technical and experiential sides of design. Technical aspects are easier to establish in a new design, because this aspect does not change. Experiential design components are more difficult to establish because each site and user population is different.

Design projects in a National Park also pose other challenges, like maintaining preservation laws. Although universal design stresses creating spaces for complete user access, that may affect the preserved landscapes. Also, it is important to incorporate universal design strategies in the early stages of design. A big challenge to adding universal design components into projects is cost, but incorporating them into concept design and continuing to strengthen them in schematic and final design phases will only assert the value that they play.

6.2 PROJECT LIMITATIONS:

In terms of the comparative analysis, some of the acts and guideline documents reviewed were very lengthy and densely written. Some aspects, pertinent to universal design may not have been discovered.

In terms of the Expanded Universal Design Guidelines, this guide may not be fully vetted. Although this guideline was applied to one projective design, it can only be strengthened when applied to several sites, and learn what needs to be adjusted from feedback.

For the project site itself, the Mammoth Hot Springs site has over 200 feet of elevation change, so only certain areas can ever strive to become accessible. The projective site design was not based on a detailed site survey and some assumptions were made in terms of grade change. A more detailed topography base would be needed for a real site design.

6.3 FUTURE RESEARCH:

In the National Park system there seems to be a shift in attitudes towards a greater use of universal design. Many of the new projects in development stages will attempt to change the way users see and experience sites. Future studies could track the progress and outcomes of these projects with the National Park Service and evaluate how each park system is making a change toward inclusive design. This could be done through case studies of individual parks or performance assessments, guided by the Expanded Universal Design Guidelines, or specific project sites.

6.4 PERSONAL REFLECTION:

Throughout this experience, the author was able to learn much more about the acts and guidelines that are in place around the country. This gives more insight on how to efficiently use these acts in design, and where the research may be flawed. The creation of expanded universal design guidelines will be a design tool for more projects to come.

The National Park Service seems to be making headway on universally designed spaces, but has a long way to go. It was refreshing to hear from those working within the park system on what they are doing for specific projects in the future. The hope is that National Park employees will be able to read this report to help generate ideas to install more universally designed spaces within individual parks.

Appendix

REFERENCES:

ADA National Network. 2019. “ADA National Network: Information, Guidance, and Training on the Americans with Disabilities Act.” Accessed December 15, 2019. https://adata.org/

ADAPT. 2020. “ADAPT-Free Our People.” Accessed on December 15, 2019. https://adapt.org/

Alzheimer’s Association. 2020. “What is Dementia?” Accessed on March 27, 2020. https://www.alz.org/alzheimers-dementia/what-is-dementia.

Anastasia Loukaitou-Sideris, Lene Levy-Storms, and Madeline Brozen. 2014. “Placemaking for an Aging Population: Guidelines for Senior-Friendly Parks.” UCLA Luskin School of Public Affairs. Accessed September 28, 2019. https://www.lewis.ucla.edu/wp-content/uploads/sites/2/2015/04/Seniors-and-Parks-8-28-Print_reduced.pdf.

American Council of the Blind. 2019. Accessed November 18, 2019. https://www.acb.org

America’s Children and the Environment. 2015. “Neurodevelopmental Disorders.” Accessed November 20, 2019. https://www.epa.gov/sites/production/files/2015-10/documents/ace3_neurodevelopmental.pdf.

Bishop, Alison, John Swain, and Hazel Bines. 1999. “Seizing the Moment: Reflections on Play Opportunities for Disabled Children in the Early Years.” British Journal of Educational Studies 47 (2): 170–83. [Journal Article from JSTOR Database]

Boster, Seth. November 2016. “Staunton State Park Unveils All-Terrain Wheelchair, with Hope of More Accessibility across Colorado.” Colorado Springs Gazette. Accessed September 18, 2019. https://gazette.com/life/staunton-state-park-unveils-all-terrain-wheelchair-with-hope-of/article_7167f8b2-9f86-5a22-ae7b-342ad28357b9.html.

Brault, Matthew W. 2010. “Household Economic Studies,” 24.

Bureau of Internet Accessibility. 2018. “Disability Statistics in the United States.” Accessed November 14, 2019. https://www.boia.org/blog/disability-statistics-in-the-united-states

Bureau, US Census. 2010. “Age and Sex Composition in the United States: 2018.” Accessed September 8, 2019. https://www.census.gov/data/tables/2018/demo/age-and-sex/2018-age-sex-composition.html.

“Colorado Parks & Wildlife - Staunton.” Accessed September 18, 2019. https://cpw.state.co.us/placestogo/parks/Staunton.

Columbia Icefield Skywalk. 2019. “Columbia Icefield Skywalk: Cliff-Edge Glass Walkway in Jasper National Park.” Accessed September 17, 2019. https://www.banffjaspercollection.com/attractions/columbia-icefield/skywalk/.

Creek, Snow. 2017. “The Five Senses of Landscape Design.” Snow Creek Landscaping (blog). Accessed September 20, 2019. https://snowcreekinc.com/five-senses-landscape-design/.

Decker, Elizabeth Florence. 2014. “A City for Marc: An Inclusive Urban Design Approach to Planning for Adults with Autism.” Report. Kansas State University. [Journal Article from JSTOR Database]

Department of Justice. September 2010. “2010 ADA Standards for Accessible Design.” Accessed November 10, 2019. https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf

Dillon, Ian and Jared Green. 2019. “Universal Design | Asla. Org.” Accessed September 10, 2019. https://www.asla.org/universaldesign.aspx.

Ellen Lupton, and Andrea Lipps. 2018. The Senses: Design Beyond Vision. New York: Cooper Hewitt, Smithsonian Design Museum and Princeton Architectural Press.

Fleischer, D. Z., and F. Zames. 2011. The Disability Rights Movement: From Charity to Confrontation. Temple University Press. [Online book for ProQuest Ebook Central]

Fletcher, Agnes, and Nick O’Brien. 2008. “Disability Rights Commission: From Civil Rights to Social Rights.” Journal of Law and Society 35 (4): 520–50. [Journal Article from JSTOR Database]

Fulton, Graeme. Dec 2017. “Accessibility Basics: Designing for Visual Impairment.” Web Design Envato Tuts+. Accessed September 17, 2019. https://webdesign.tutsplus.com/articles/accessibility-basics-designing-for-visual-impairment--cms-27634.

Gleeson, B. J. 1996. “A Geography for Disabled People?” Transactions of the Institute of British Geographers 21 (2): 387–96. [Interlibrary Loan Resource]

Goldsmith, Selwyn. 1997. Designing for the Disabled: The New Paradigm. Oxford ; Boston: Architectural Press.

Gostin, Lawrence O. 2015. “The Americans With Disabilities Act at 25: The Highest Expression of American Values.” JAMA 313 (22): 2231–35. [Journal Article found in JSTOR Database]

GovTrack.us. 2004. “GovTrack.us: Tracking the United States Congress.” Accessed December 15, 2019. https://www.govtrack.us/

Grand Teton National Park. 2019. “Accessibility Self-Evaluation and Transition Plan: Grand Teton National Park: John D. Rockefeller, JR. Memorial Parkway.” National Park Service: Department of the Interior. Accessed October 9, 2019.

Green, Jared. 2015. “Sensory Overload: How People with Autism Experience the World.” THE DIRT (blog). June 9, 2015. https://dirt.asla.org/2015/06/09/how-people-with-autism-experience-the-world/.

Gustafson Porter + Bowman. 2012. “Woolwich Squares.” Accessed on February 10, 2020. http://www.gp-b.com/woolwich-squares

Hall, Francine S., Elizabeth L. Hall, Janet Reno, Thomas C. Anderson, Frank Scalia, Daniel Dryer, and Victor S. Barocas. 1994. “The ADA: Going beyond the Law [and Executive Commentary].” The Academy of Management Executive (1993-2005) 8 (1): 17–32.

Harpers Ferry Center Accessibility Committee. 2017. “Programmatic Accessibility Guidelines for National Park Service Interpretive Media.” National Park Service. https://www.nps.gov/features/hfc/guidelines/#h.xqp7xln4gjlx.

Holden, Courtney. January 2018. “Mammoth Hot Springs Looks Like an Inside-Out Cave.” My Yellowstone Park. Accessed September 17, 2019. https://www.yellowstonepark.com/things-to-d/mammoth-hots-springs-inside-cave.

Interagency Visitor Use Management Council. June 2019. "Monitoring Guidebook: Evaluating Effectiveness of Visitor Use Management." Accessed February 5, 2020. https://visitorusemanagement.nps.gov/Content/documents/highres_final_Monitoring_Guidebook_Edition_One_IVUMC.pdf

Interagency Visitor Use Management Council. 2016. "Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation." Edition 1. Accessed January 28, 2020.

2019. "Join the Global Compact on Inclusive and Accessible Cities." Cities For All: Global Compact on Inclusive and Accessible Cities (blog). Accessed September 29, 2019. http://www.cities4all.org/join-the-global-compact-on-inclusive-and-accessible-cities/.

Kusume, Yasushi, and Yasushi Kusume. 2015. "Designing For All Five Senses." Fast Company. September 9, 2015. https://www.fastcompany.com/3050854/designing-for-all-five-senses.

Kwak-Hefferan, Elisabeth. July 2019. "About Old Faithful, Yellowstone's Famous Geyser." My Yellowstone Park. Accessed September 17, 2019. https://www.yellowstonepark.com/things-to-do/about-old-faithful.

Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.

Management of National Park Service Programs. August 2006. "Management Policies 2006" Accessed September 8, 2019. https://www.nps.gov/policy/mp/policies.html#_Toc157232632.

March of Dimes. 2020. "March of Dimes." Accessed February 17, 2020. https://www.marchofdimes.org/

Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]

Medline Plus. 2019. "Neurocognitive Disorder: MedlinePlus Medical Encyclopedia." Accessed October 7, 2019. https://medlineplus.gov/ency/article/001401.htm.

Medline Plus. October 2019. "Alzheimer Disease: MedlinePlus Medical Encyclopedia." n.d. Accessed October 7, 2019. https://medlineplus.gov/ency/article/000760.htm.

Meteo-blue: Weather Close to You. 2020. "Climate Yellowstone National Park." Accessed on February 12, 2020. https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/yellowstone-national-park_united-states-of-america_5843642.

National Federation of the Blind. 2019. "National Federation of the Blind." Accessed December 20, 2019. https://www.nfb.org/

National Institute of Building Sciences. June 20, 2011. "Guidelines for Designing for Persons with Low Vision." n.d., 6. Accessed October 1, 2019. https://cdn.ymaws.com/www.nibs.org/resource/resmgr/LVDC/GuidelinesDesigningLV.pdf

National Park Service (1). February 2017. "Accessibility-Guide_web_20170731.Pdf." Accessed September 5, 2019. https://www.nps.gov/yell/planyourvisit/upload/Accessibility-Guide_web_20170731.pdf.

National Park Service (2). August 2019. “Accessibility - Grand Teton National Park (U.S. National Park Service).” Accessed September 5, 2019. https://www.nps.gov/grte/planyourvisit/accessibility.htm.

National Park Service (3). 2019. “Accessibility & Universal Design Standards - (U.S. National Park Service).” Accessed September 5, 2019. https://www.nps.gov/dscw/ds-accessibility-universal-design.htm.

National Park Service (4). August 2014. “All In! Accessibility in the National Park Service.” Accessed September 28, 2019. https://www.nps.gov/aboutus/upload/All_In_Accessibility_in_the_NPS_2015-2020_FINAL.pdf.

National Park Service (5). 2019. “Denver Service Center (U.S. National Park Service).” Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.

National Park Service (6). 2019. “Fort Yellowstone.” Accessed January 31, 2020. https://www.nps.gov/yell/learn/historyculture/fort-yellowstone.htm

National Park Service (7). 2019. “Hydrothermal Features.” Accessed January 31, 2020. https://www.nps.gov/yell/learn/nature/hydrothermal-features.htm

National Park Service (8). 2019. “Mammoth Hot Springs Historic District.” Accessed January 31, 2020. https://www.nps.gov/yell/learn/historyculture/mammothhotsprings.htm

National Park Service (9). October 1992. “Preserving the Past and Making It Accessible for People with Disabilities.” Accessed September 29, 2019. http://hdl.handle.net/2027/umn.31951d014787065.

National Park Service (10). 2017. “Thomas Moran’s Diary.” Accessed February 12, 2020. https://www.nps.gov/yell/learn/historyculture/thomasmoransdiary.htm.

National Park Service (11). 2019. “Weather.” Accessed on February 3, 2020.

National Park Service (12). 2014. “Foundation Document: Yellowstone National Park.” Accessed February 28, 2020. https://www.nps.gov/yell/learn/management/upload/YELL_FD_FINAL_SP.pdf.

NC State University. 1997. “The Principles of Universal Design.” Accessed February 5, 2020. https://projects.ncsu.edu/ncsu/design/cud/pubs_p/docs/poster.pdf

Hershberger Design. 2020. “Hershberger Design.” Accessed September 17, 2019. http://hershbergerdesign.com/.

Oliver, Mike, and Colin Barnes. 2010. “Disability Studies, Disabled People and the Struggle for Inclusion.” British Journal of Sociology of Education 31 (5): 547–60.

Paralyzed Veterans of America. 2020. “Paralyzed Veterans of America.” Accessed December 20, 2019. https://pva.org/

Pletcher, Kenneth. N.d. “National Park Service: United States Government Agency.” Accessed September 30, 2019. https://www.britannica.com/topic/National-Park-Service.

Social Security. 2017. “The Social Security Act of 1935.” Accessed February 17, 2020. https://www.ssa.gov/history/35act.html

Steinfeld, Edward and Jordana Maisel. 2012. Universal Design: Designing Inclusive Environments. P. 27-31. Accessed October 16, 2019.

Taylor, Danielle. 2018. “Americans With Disabilities: 2014.” n.d., 32. Accessed November 5, 2019. https://www.census.gov/content/dam/Census/library/publications/2018/demo/p70-152.pdf

The Trust for Public Land. 2018. “Story Mill Community Park.” Accessed October 28, 2019. https://www.tpl.org/our-work/story-mill-community-park.

United States Access Board. Sept. 2002. “ADAAG - United States Access Board.” Accessed September 4, 2019. https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag#4.1.

United States Access Board. Outdoor Developed Areas: A Summary of Accessibility Standards for Federal Outdoor Developed Areas. May 2014. Washington D.C. United States Access Board.

United States Access Board. September 2018. “Architectural Barriers Act - United States Access Board.” Accessed September 5, 2019. https://www.access-board.gov/the-board/laws/architectural-barriers-act-aba.

U.S. Equal Employment Opportunity Commission. 2008. “The Americans with Disabilities Act Amendments Act of 2008.” Accessed December 15, 2019. https://www.eeoc.gov/laws/statutes/adaaa_info.cfm.

Vaughn, Alexa. n.d. Ground Up. “Deafscape.” Accessed September 17, 2019. http://groundupjournal.org/deafscape.

Winterbottom, Daniel and Amy Wagenfeld. Therapeutic Gardens: Design for Healing Spaces. 2015. Portland. Timber Press.

Yasmin, Sumrana and Brien Holden. 2019. “Low Vision.” IAPB (blog). Accessed September 17, 2019. https://www.iapb.org/knowledge/what-is-avoidable-blindness/low-vision/.

FIGURES CITED:

Front Matter:
Figure A. Noun Project. (2019). Universal Design logos. www.thenounproject.com
Figure B. Noun Project. (2019). Universal Design logos. www.thenounproject.com
Figure C. Hahn, Howard. (2019). Mammoth Panoramic Picture. Photo.

Chapter 1:
Figure 1.0. Cross, Rachel. (2019). Photo of Hymen Terrace and Palette Springs. Photo.
Figure 1.1. Cross, Rachel. (2020). Diagram about goal, objectives, and outcomes of project. Photo.

Chapter 2:
Figure 2.0. Cross, Rachel. (2019). Minerva Terrace at Mammoth Hot Springs. Photo.
Figure 2.1. Cross, Rachel. (2019). “Literature Map with Citation Numbers (see citations in Appendix). Adobe InDesign.
Figure 2.2. Cross, Rachel. (2020). Visitor Use Management Framework. Adobe InDesign.

Chapter 3:
Figure 3.0. Hahn, Howard. (2019). Close up of Terrace Formations in the Minerva Terrace. Photo.
Figure 3.1. Cross, Rachel. (2020). Comparative Analysis Diagram. Adobe InDesign.
Figure 3.2. Cross, Rachel. (2020). Graphic showing site for projective design. Adobe photoshop/Adobe InDesign.

Chapter 4:

Figure 4.0. Hahn, Howard. (2019). Close up of Minerva Terrace at Mammoth Hot Springs. Photo.
Figure 4.1. Hodgson, Danielle. (2018). Staunton State Park Trail. Photo.
Figure 4.2. Staunton State Park: Track-Chair Program. (2020). Track-Chair used at Staunton State Park. Photo. https://cpw.state.co.us/placestogo/parks/Staunton/Pages/Track-Chair-Program.aspx
Figure 4.3. Cross, Rachel. (2019). Interpretive Media along trail at Jenny Lake. Photo.
Figure 4.4. Cross, Rachel. (2019). Jenny Lake and 3D element. Photo.
Figure 4.5. Cross, Rachel. (2019). Accessible Pathways and art elements. Photo.
Figure 4.6. Cross, Rachel. (2019). Story Mill Park: Interpretive Signage of park. Photo.
Figure 4.7. Hollman, Shelby. (2019). Columbia Icefield Skywalk. Photo.
Figure 4.8. Hollman, Shelby. (2019). Interpretive Signage at entrance of Skywalk. Photo.
Figure 4.9. Street-Porter, Time and James Corner Field Operations. (2018). Tongva Park and Ken Genser Square Areal View. Photo.
Figure 4.10. Street-Porter, Time and James Corner Field Operations. (2018). Lookout at Tongva Park and Ken Genser Square. Photo.
Figure 4.11. Whippet, Chris. (2017).General Gordon Square, Woolwich. Photo. https://www.geograph.org.uk/photo/5382265
Figure 4.12. Kleon3. View towards the southwest of General Gordon Square in central Woolwich, South East London. (2015). https://commons.wikimedia.org/wiki/File:2015_London-Woolwich,_General_Gordon_Square_1.jpg
Figure 4.13. Mikyoung Kim Design. (2019). McIntire Botanical Garden Concept Image. Photo. https://myk-d.com/projects/mcintire-botanical-garden/
Figure 4.14. Mikyoung Kim Design. (2019). McIntire Botanical Garden Concept Image. Photo. https://myk-d.com/projects/mcintire-botanical-garden/
Figure 4.15. Google Earth. (2019). Demonstration Gardens Image. Photo.
Figure 4.16. Google Earth. (2019). Demonstration Gardens Image. Photo.
Figure 4.17. Cross, Rachel. (2020). Context Map of Mammoth Hot Springs Region. Adobe InDesign and Google Earth.
Figure 4.18. Cross, Rachel. (2019). Scope of Projective Design. Adobe InDesign and Google Earth.
Figure 4.19. Cross, Rachel. (2020). Most visited attractions in Yellowstone National Park. National Park Service and InDesign.
Figure 4.20. Cross, Rachel. (2020). Palette Spring in the Hymen Terrace (travertine terraces). Photo and Adobe Illustrator.
Figure 4.21. Cross, Rachel. (2020). Terrace/Spring locations throughout Mammoth Hot Springs. Adobe InDesign and Google Earth.
Figure 4.22. Cross, Rachel. (2019). View from the top of the Main Terrace in Mammoth Hot Springs. Photo.
Figure 4.23. Cross, Rachel. (2020). Photographs of terraces throughout the site. Photos, Google Earth, and Adobe InDesign.
Figure 4.24. Cross, Rachel. (2020). Contour map showing every 10 ft. change at Mammoth Hot Springs. Google Earth, ArcGis Map.
Figure 4.25. Cross, Rachel. (2020). Three Dimensional view of the site to show the topography. Google Earth.
Figure 4.26. Cross, Rachel. (2020). Hymen Terrace Inventory and Analysis. Google Earth and photos.
Figure 4.27. Cross, Rachel. (2020). Upper Terraces Inventory and Analysis: Closer look at the site. Google Earth and photos.
Figure 4.28. Cross, Rachel. (2020). Vegetation on site and surrounding context. Google earth and photos.

Figure 4.29. Cross, Rachel. (2020). Amenities in the general region of Mammoth. Google Earth and Adobe InDesign.
Figure 4.0. Cross, Rachel. (2020). Existing circulation of the site. Google Earth and Adobe Illustrator.
Figure 4.31. Cross, Rachel. (2020). Parking zones surrounding Mammoth Hot Springs. Google Earth and Adobe InDesign.
Figure 4.32. Cross, Rachel. (2020). **Site opportunities for entry, educational zones, and exploration zones.** Google Earth and Adobe InDesign.

Chapter 5:
Figure 5.0. Cross, Rachel. (2019). Liberty Cap at Hymen Terrace. Photo.
Figure 5.1. Cross, Rachel. (2019). Universal Design Graphic. Adobe Illustrator and Adobe InDesign.
Figure 5.2. Cross, Rachel. (2019). Accessibility Categories of Universal Design Guidelines. Adobe InDesign and thenounproject.
5.2.1 United States Access Board. Sept. 2002. "ADAAG - United States Access Board." Accessed September 4, 2019. https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag#4.1.
5.2.2 Interagency Visitor Use Management Council. 2016. "Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation." Edition 1. Accessed January 28, 2020.
5.2.3 National Parks Service. 2020. "National Park Service." Accessed January 20, 2020.
5.2.4 American Society of Landscape Architecture. 2020. "American Society of Landscape Architecture: Home." Accessed April 2, 2020.
Figure 5.3. Cross, Rachel. (2019). Enrichment Categories of Universal Design Guidelines. Adobe InDesign and thenounproject.
5.3.1 Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.
5.3.2 Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]
5.3.3 Interagency Visitor Use Management Council. 2016. "Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation." Edition 1. Accessed January 28, 2020.
5.3.4 National Park Service (5). 2019. "Denver Service Center (U.S. National Park Service)." Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.
5.3.5 American Society of Landscape Architecture. 2020. "American Society of Landscape Architecture: Home." Accessed April 2, 2020.
Figure 5.4. Cross, Rachel. (2019). Multi-Sensory Categories of Universal Design Guidelines. Adobe InDesign and thenounproject.
5.4.1 Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.
5.4.2 Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]
5.4.3 National Park Service (5). 2019. "Denver Service Center (U.S. National Park Service)." Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.
5.4.4 American Society of Landscape Architecture. 2020. "American Society of Landscape Architecture: Home." Accessed April 2, 2020.
Figure 5.5. Cross, Rachel. (2019). Engagement Categories of Universal Design Guidelines. Adobe InDesign and thenounproject.

5.5.1 Lupton, Ellen and Andrea Lipps. May 2018. The Senses: Design Beyond Vision. P.60-85,138-148. Accessed September 28, 2019.
5.5.2 Marcus, Clare Cooper and Naomi A Sachs. 2014. Therapeutic Landscapes: An Evidence-Based Approach to Designing Healing Gardens and Restorative Outdoor Spaces. Hoboken, New Jersey. John Wiley and Sons Inc. [Interlibrary Loan Book]
5.5.3 Interagency Visitor Use Management Council. 2016. "Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation." Edition 1. Accessed January 28, 2020.
5.5.4 National Park Service (5). 2019. "Denver Service Center (U.S. National Park Service)." Accessed October 28, 2019. https://www.nps.gov/orgs/1804/index.htm.
5.5.5 American Society of Landscape Architecture. 2020. "American Society of Landscape Architecture: Home." Accessed April 2, 2020.
Figure 5.6. Cross, Rachel. (2020). Projective Design program and elements from Expanded Universal Design. Adobe InDesign.
Figure 5.7. Cross, Rachel and NPS (12) 2014. (2020). Primary, Secondary, and Vegetated Zones are shown as to how preservation criteria plays a role in the design. Adobe InDesign.
Figure 5.8. Cross, Rachel. (2020). Plan view of concept 1 design. Adobe InDesign and Adobe Illustrator.
Figure 5.9. Cross, Rachel. (2020). Plan view of Hymen Terrace Enlargement. Adobe Illustrator and Adobe InDesign.
Figure 5.10. Cross, Rachel. (2020). Plan view of Reflection Zone Enlargement. Adobe Illustrator and Adobe InDesign.
Figure 5.11. Cross, Rachel. (2020). Plan view of Concept 2 design. Adobe Illustrator.
Figure 5.12. Cross, Rachel. (2020). Plan view of Jupiter Terrace Enlargement. Adobe Illustrator and Adobe InDesign.
Figure 5.13. Cross, Rachel. (2020). Plan view of Minerva Terrace and sketched view. Adobe Illustrator and Adobe InDesign.
Figure 5.14. Cross, Rachel. (2020). Concept Diagram of Site Design. Adobe Illustrator.
Figure 5.15. Cross, Rachel. (2020). Plan view of new design at Mammoth Hot Springs. Auto Cad and Adobe Photoshop.
Figure 5.16. Cross, Rachel. (2020). Existing pedestrian/vehicular circulation at Mammoth Hot Springs. Adobe Illustrator.
Figure 5.17. Cross, Rachel. (2020). New pedestrian/vehicular circulation at Mammoth Hot Springs. Adobe Illustrator.
Figure 5.18. Cross, Rachel. (2020). Phases of design. Adobe Illustrator.
Figure 5.19. Cross, Rachel. (2020). Enlargement call outs of new design at Mammoth Hot Springs. Adobe Photoshop and Adobe InDesign.
Figure 5.20. Cross, Rachel. (2020). Plan of Hymen Terrace enlargement. Adobe Photoshop and Auto Cad.
Figure 5.21. Cross, Rachel. (2020). Section of Hymen Terrace enlargement. Auto Cad and Adobe Photoshop.
5.21.1 National Park Service (12). 2014. "Foundation Document: Yellowstone National Park." Accessed February 28, 2020. https://www.nps.gov/yell/learn/management/upload/YELL_FD_FINAL_SP.pdf.
Figure 5.22. Cross, Rachel. (2020). Plan of Minerva Terrace enlargement. Auto Cad and Adobe Photoshop.
Figure 5.23. Cross, Rachel. (2020). Section of Enlargement at Minerva Terrace. Auto Cad and Adobe Photoshop.
5.23.1 National Park Service (12). 2014. "Foundation Document: Yellowstone National Park." Accessed February 28, 2020. https://www.nps.gov/yell/learn/management/upload/YELL_FD_FINAL_SP.pdf.
Figure 5.24. Cross, Rachel. (2020). Plan of Main Terrace enlargement. Auto Cad and Adobe Photoshop.
Figure 5.25. Cross, Rachel. (2020). Section of Main Terrace enlargement. Auto Cad and Adobe Photoshop.
5.25.1 National Park Service (12). 2014. "Foundation Document: Yellowstone National Park." Accessed February

28, 2020. https://www.nps.gov/yell/learn/management/upload/YELL_FD_FINAL_SP.pdf.
Figure 5.26. Cross, Rachel. (2020). Existing View of the Main Terrace (top portion of the site). Photo.
Figure 5.27. Cross, Rachel. (2020). Perspective view highlighting how the projective design can create new opportunities for those with limited mobility. Photo, Sketchup, Adobe Photoshop
Figure 5.28. Cross, Rachel. (2020). View of existing location where secondary zone will be. Photo.
Figure 5.29. Cross, Rachel. (2020). Perspective view showing secondary zone on the edge of the Minerva Terrace. Photo, SketchUp, and Adobe Photoshop.
5.29.1 National Park Service (12). 2014. "Foundation Document: Yellowstone National Park." Accessed February 28, 2020. https://www.nps.gov/yell/learn/management/upload/YELL_FD_FINAL_SP.pdf.
Figure 5.30. Cross, Rachel. (2020). Existing view of the Minerva Terrace and the existing trail system. Photo.
Figure 5.31. Cross, Rachel. (2020). Perspective view of newly designed Minerva Terrace bump out. Photo, Sketchup, and Adobe Photoshop.
5.31.1 National Park Service (12). 2014. "Foundation Document: Yellowstone National Park." Accessed February 28, 2020. https://www.nps.gov/yell/learn/management/upload/YELL_FD_FINAL_SP.pdf.
Figure 5.32. Cross, Rachel. (2020). Existing view of the entry into the site at Hymen Terrace in Mammoth Hot Springs. Photo.
Figure 5.33. Cross, Rachel. (2020). Perspective view showing how interpretive media can impact those with hearing loss. Photo, SketchUp, and Adobe Photoshop.
Figure 5.34. Cross, Rachel. (2020). Existing view showing the circulation of Hymen Terrace to the Palette Springs. Photo.
Figure 5.35. Cross, Rachel. (2020). Proposed perspective view of the new entry into Hymen Terrace. Photo, SketchUp, and Adobe Photoshop.

Chapter 6:
Figure 6.0. Cross, Rachel. (2019). Main Terrace view. Photo.

TABLES CITED:

Chapter 2:
Table 2.0. Cross, Rachel. (2019). Focused Disability Types. Adobe Illustrator.
Chapter 4:
Table 4.0. Cross, Rachel and Meteo-Blue: Weather Close to you. (2020). Temperature average high and low, and average rainfall and snow throughout the year. Adobe InDesign.
Table 4.1. Cross, Rachel and Meteo-Blue: Weather Close to you. (2020). Wind speed average highs and lows throughout the year in Yellowstone. Adobe InDesign and Adobe Illustrator.
Table 4.2. Cross, Rachel. (2020). Sectional cut of site: Main Terrace to Hymen Terrace. Adobe InDesign and Adobe Illustrator.
Chapter 5:
Table 5.0. Cross, Rachel. (2020). Goals, Objectives and Outcomes to guide the projective design. Adobe InDesign.
Table 5.1. Cross, Rachel and NPS (12). (2020). Preservation guidelines from Yellowstone's Foundation Document. Adobe InDesign.

INTERVIEWS TRANSCRIPTS:

Leigh Dunworth
When interview took place: November 20, 2019
Type of interview: Through Email

People based questions on accessibility and inclusive design:
1. What are some of the barriers to implementing inclusive design? "There is no dedicated funding source for accessibility at the park, region, or national levels.

There is a lack of awareness, knowledge, understanding, and importance of ABAAS by some staff. There is no "enforcement" of ABAAS."
"Sometimes it's a challenge to get our maintenance staff or contractors to build projects that meet ABA standards. Some people see inclusive design as an added expense."
1b. How have they been overcome in Yellowstone? "Making small differences, on the ground, that add up. For example, repairing transitions between walking surfaces, installing accessible fire rings in campgrounds, restriping parking lots, and improving signage. Some accessibility projects have been funded through the Federal Lands Recreation Enhancement Act (money from visitor entrance fees). The Federal Highways Administration (FHWA) has funded many road projects that have enhanced accessibility at parking areas, wayside exhibits, trailheads, and overlooks.
A two-day accessibility training was provided for interested employees in 2015. There were also accessibility self-evaluation and transition plan workshops held at Grand Teton National Park in 2017 and 2018. We hope to have another accessibility training this spring.
The park accessibility coordinator (a landscape architect) and the accessibility technician (me) continue to share information with park staff to provide awareness of the importance of universal design. We review site plans, construction drawings, and design details to ensure compliance with ABA standards.
Our web team ensures that documents on our website meet Section 508 of the Rehabilitation Act of 1973. Planning and media staff, in the division of Resource Education, make sure visitor center exhibits, waysides, and printed publications are accessible to people with different types of disabilities."

Park Affiliation Questions:
2. Overall, do you feel like the National Park System is making progress towards inclusive design? "Yes. The completion of a self-assessment and transition plan that was one of the goals of "All In!" is a good start."
3. Through some of my extended research, I've noticed a fairly new trend of NPS publishing documents in regards to creating better accessibility for those with all different types of disabilities (All In! Accessibility in National Parks). Do you believe that this is another step to introducing inclusive design or removing minimal barriers/ technical considerations? "Yes, but my personal opinion and impression is that there really hasn't been any follow up since "All in!" was published, except parks have begun writing self-assessments and transition plans."
"The NPS needs a service-wide initiative to improve accessibility."
4. When creating an inclusive design, are there any extra maintenance requirements that differ from other park facilities? "The presence of hydrothermal resources and thermally-influenced soils are factors that need to be considered. Yellowstone landscape architects and engineers work closely with the park geologist on all projects."
"Snow and ice need to be considered, and we can have either one any time of the year! Steep topography presents constraints. There can also be an increased workload, due to a range of materials that need to be maintained."
5. Do parts of the park (Yellowstone) close during parts of the year? "Yes. Park roads close after the first weekend of November, except for the road between the North Entrance at Gardiner, Montana, and the Northeast Entrance at Cooke City, MT. Closed roads are not plowed and are groomed for over snow travel (snowmobiles and snow coaches) during the winter months, usually starting just before Christmas. Roads have phased openings in spring."
"(In Mammoth Hot Springs), some sections of boardwalk may be closed due to snow and ice. It's truly a magical place in the winter! Our maintenance staff removes snow from certain sections--like the route to Palette Spring. The

Upper Terrace Drive is closed to vehicles and becomes a groomed cross country ski trail during the winter."
5b. How does seasonality impact inclusively designed sites? "Snow, as well as snow removal, can create problems. Very few boardwalks or walkways are cleared in the winter. Curb cuts are often not accessible.
"Popular features are very crowded during the summer, making parking difficult or sometimes impossible."
6. Are there any planned inclusive design projects in the works? "Improvement of existing campsites and establishment of new accessible campsites is ongoing. The park concessioner, Xanterra Parks and Resorts is in the process of implementing major accessibility improvements at the Fishing Bridge RV Park. Parking at Roosevelt Lodge is being redesigned to improve accessibility. Our office has also submitted a proposal to construct an accessible fishing platform at the Nez Perce Ford picnic area, along the Yellowstone River. (There are only two others in the park.)"
7. Who decides the final design for the projects? "Ultimately, the final decision is up to Yellowstone's chief of facilities and operations ("maintenance") and the park superintendent." "An interdisciplinary team, including a landscape architect would provide alternatives and recommendations for design projects. In the case of Federal Highway Administration (FHWA) projects in the park, our landscape architects, who are also project managers, work closely with FHWA engineers."
8. Are there groups outside of the National Park System that have donated to these projects? "Yellowstone Forever (YF) is the primary education and fundraising partner for Yellowstone. Many individuals and corporations donate money to the park through YF."
9. Can you point me to really good examples of inclusively designed sites? (in the National Park System or outside) "In Yellowstone, I would look at the North and South Rim Drives of the Grand Canyon of the Yellowstone and the Canyon Visitor Center. These are recent projects that have been implemented that have significantly improved accessibility. Also, all of our road reconstruction projects have improved access to parking, overlooks, and wayside exhibits. They have been very well designed.
Universal Design Standards:
10. ASLA recently came out with a universal design standard guide which addresses techniques on how to address those who have different disabilities. When designing for all people, are there any guidelines or standards that you have to follow? "Laws and standards include the Architectural Barriers Act of 1968; Section 504 of the Rehabilitation Act of 1973; Section 508 of the Rehabilitation Act of 1973; and Accessibility Standards for Outdoor Developed Areas (2014). The National Park Service (NPS) must also comply with NPS Director's Order 42 and NPS Management Policies: Section 1.0.3 – Accessibility for Persons with Disabilities."
11. What particular design strategies or features do you see as most successful, in terms of inclusive design? "I'll quote Accessibility Standards for Outdoor Developed Areas, "Incorporating accessibility into the design of outdoor developed areas must begin early in the planning process, with careful consideration given to the location of accessible elements and the routes that connect them." "We need to remember that ABA standards are the minimum."
12. Were there specific precedents that you used when designing (sites within the National Park)? "Much of our design work is redesigning existing sites, usually due to aging infrastructure."
Other Questions:
13. Are there any aspects of inclusively designed spaces that need improvement? "Cyclic maintenance, especially transitions between walking surfaces, needs improvement."
14. What opportunities do you see for the future of inclusive design in Yellowstone? "We would like to see inclusive design incorporated into all projects." "That our

engineers, landscape architects, interpretive planning and media staff, Federal Highways designers—all NPS employees-- and our concessioners, comply with ABA and Accessibility Standards for Outdoor Developed Areas. In addition, each area of the park that has a road improvement project has the opportunity to improve accessibility through the Federal Highways program."

Jessica Brown
When interview took place: December 11, 2019
Type of interview: Through Email

People based questions on accessibility and inclusive designs:
1. What are some of the barriers to implementing inclusive design/universal design?
"Some common barrier include slope, disturbance area allowed, and other various site constraints."
"In many instances designing for inclusivity requires additional space which is not always desired or allowed on GRTE projects. Inclusive design is an afterthought which means it does not get included into the design. We will then be meeting the minimum ABAAS requirements. Historical buildings or structures are often hard enough to make accessible let alone inclusive."
1b. How have they been overcome in Grand Teton National Park? "This is a work in progress. The best and most proper time to bring in inclusive design is during the schematic or concept development phase of design. This ensures it is incorporated early on in the design process."
Park Affiliation Questions:
2. Overall, do you feel like the National Park System is making progress towards inclusive design? "Yes, GRTE is becoming more aware and therefore bringing it into the design and maintenance process."
2b. In what ways?
- Completed Self Evaluation and Transition Plan – July 2019
- Formed the Park Accessibility Team – consisting of three members in various divisions
- Began updating accessibility brochure to make 508 compliant. 2020 will include in app and website.
- Completed the Backcountry Service Animal Brochure – 508 compliant
- Completed the Jenny Lake Renewal – accessibility focus
- Completed the Jenny Lake Campground shower – accessible
- Interpretation accessibility training
- Steve Wolter visit from the Eppley Institute, to learn how GRTE is focusing on accessibility.
- Oct. 2018 Park wide accessibility training with US Access Board. This was a great way to train employees on accessibility.

3. When creating an inclusive design, are there any extra maintenance requirements that differ from other park facilities? "YES! A particularly difficult maintenance issue is the firm and stable surface. Gravel surfaces can and should be used as a surface in parks. It has a texture and sound that is important for visitors and is something I feel is important when thinking about inclusive design; however the maintenance of the surface is extremely difficult to maintain as firm and stable in all seasons (we have used polymers etc). General everyday maintenance requires an understanding of the requirements in ABAAS. Things like trash cans get placed in important routes or signs installed at the wrong height."
4. How does seasonality impact inclusively designed sites? "It greatly impacts the materials we choose to use. Such as gravel surfaces. We think of seasons in everything we do. We need more room for snow in the winter in our parking areas, but often need more parking spaces in the summer."
5. Who decides the final design for the projects? "The park interdisciplinary team and ultimately the superintendent."

Universal Design Standards:

6. ASLA recently came out with a universal design standard guide which addresses techniques on how to address those who have different disabilities. When designing for all people, are there any guidelines or standards that you have to follow?

- "The Architectural Barriers Act (ABA) of 1968 is one of the earliest measures by Congress to address access to the built environment, requiring facilities designed, built, altered, or leased with federal funds to be accessible according to established standards." "Subsequently the Rehabilitation Act of 1973 was established which prohibits discrimination on the basis of disability in programs run by federal agencies. Specifically, Section 504 of the Act requires access to programs and activities that are funded by federal agencies and to federal employment.
- The preparation of a self-evaluation and a transition plan is mandated by regulations under the Rehabilitation Act of 1973 as they apply to the US Department of the Interior. It is necessary to evaluate park policies and practices, to document architectural barriers, physical solutions to eliminate the barriers, timeframes for corrective actions, and persons responsible for conducting the work and to consult with people or organizations representing people with disabilities.
- The National Park Service (NPS) is committed to making facilities, programs, services, and employment accessible for visitors and employees with disabilities through compliance with the Architectural Barriers Act of 1968, the Rehabilitation Act of 1973, and the Americans with Disabilities Act of 1990. The accessibility of commercial services within national parks is also covered under all applicable federal, state, and local laws.
- In November of 2000 - DO#42 came out and provided a comprehensive approach to providing accessibility for visitors with disabilities in programs and services.
- Most recently in May of 2012 the National Park Service formed the Accessibility Task Force to improve an organizational approach to ensuring that national parks can be enjoyed by people with disabilities. The task force developed a five year strategic plan for improving accessibility from 2015-2020. "

https://www.nps.gov/dscw/ds-accessibility-universal-design.htmhttps://projects.ncsu.edu/ncsu/design/cud/about_ud/udprinciplestext.htm

7. What particular design strategies or features do you see as most successful, in terms of inclusive design? "Interpretative media – especially with our latest Grand Teton Places app."

Hans Flinch
When interview took place: December 13, 2019
Type of Interview/Duration: Phone call | 15:23

1st off, would you like to be affiliated with your answers or remain anonymous?
-"yeah, I'm fine with that!"
Design Related Questions:

1. Do people use the spaces in the way that you predicted or different ways that are surprising to you (Jenny Lake Design)?

"I would say the latter is the correct answer. The nice thing about Jenny Lake is it's so close to us that we're able to get up there and check on it. I take my family and kids there usually a couple times a year. It's interesting to see how people are using it the way it's meant but also in surprising ways. The biggest one that comes in mind is the for the widened asphalt paths that are wheelchair friendly are mistaken a lot of bike paths. Grand Teton is known for their healthy amount of bikes due to their bike path system, but that is something that we have noticed how people are using the new Jenny Lake design unexpectedly."

2. Do you believe that since the new design was

opened (Jenny Lake), that there has been a visitation increase to the site?

“That is a hard question, because part of the reason that we were brought on for the Jenny Lake redesign was that this area is the most popular destination of Grand Teton National Park. The whole project’s goal was to give this area a big face lift to help with Grand Teton’s visitor rise as a whole. The whole project started because this area of the park was receiving such high numbers of people, that it was creating detrimental effects to the areas surrounding the lake. I don’t think I can contribute rise in the project alone, but there has been a rise in overall park visitation which began the need for a better design of Jenny Lake.”

Feedback from users of the site (Jenny Lake)?

“Prior to the redesign there was a lot of social trails and erosion that was being created by people wanting to get to the water. There was no accessible route to get to the lake. I would say that was a defined uptick in feedback from other clients who have relatives with needs in the area and they have said that they have been able to get these relatives right down to the water through the rock beach area. This was not the case prior to the redesign. So I think we have had direct feedback for that influx of visitation.”

3. Have there been any barrier to implementing inclusive design (Jenny Lake)?

“Like any project, cost was a barrier. We had to go through many value engineering iterations. The project was different than it was first drawn out, but I believe that it was better in the long run because of it.”

Other Questions:

4. Overall, do you feel like the National Park System is making progress towards inclusive design?

“In my experience so far, I would say yes! In the Jenny Lake redesign, and at Grand Teton as a whole they wanted to make sure that everything was under ABAAS standards. That was pretty much non-negotiable. That was driven by the Grand Teton National Park, Grand Teton National Park Foundation, and Denver Service Center (NPS over seer). We did a competition project for the Grand Canyon at Yellowstone National Park. All though we got 2nd place, but one of the requirements there was to design these plaza areas so that we were meeting all accessibility standards. This is all front country in Yellowstone. Prior to this redesign, there was 5-10 pull off areas that were being loved to death and became to be unsafe because of the dramatic drops into the canyon. The big goal of that project was to create a safe and accessible design...for all people to enjoy equally.”

5. When creating an inclusive design, are there any extra maintenance requirements that differ from other park facilities?

“Like on going maintenance?”

Yeah, to keep the design up to date?

“I don t know because with most places that implement inclusive design, you are using harder materials such as asphalt that aren’t wearing out as easily. If you implement asphalt properly it shouldn’t even crack, so I don’t think so. I haven’t really thought much about extra maintenance for this type of design before.”

6. I know in the National Park System, there are certain standards that they follow. When working with on a design in a Park are there specific design standards that you have to follow?

“Well with Jenny Lake, we were held up to the ABAAS standards. Working with that framework is a good thing for our design to live up to, but does bring up challenges. One of the best examples I could give is the rock beach. Originally the goal was to just get all people to the water. With ABAAS, we had to reevaluate our design of that part because it was literally a concrete surface going straight into the water, and you can only have so much hard surface that close to the water. But I think the design is cooler now, because we poured the concrete pad designed to flood enough that someone could roll their wheelchair in but be

immersed into the water. Also, this part doesn't completely meet ABAAS, but there is a boulder ramp so that if someone had some extra help, they could easily roll onto the beach with the rest of their family."
"As a firm, we new what our goal was, so we decided to look through another lens and make a better design than what we decided for in the first place."

PHOTO REPRINT PERMISSIONS:

- Email from Brook Dexter (marketing coordinator at Field Operations) on Tuesday February 4, 2020 with photo credit permission for the Tongva Park project.
- Email from Nadia Zimo (marketing + administrative assistant at Mikyoung Kim Design) on January 31, 2020 for the permission to use McIntire Botanical Garden graphics.
- All other photos are used with permission or are covered under creative commons.

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Jessica Canfield
Landscape Architecture/Regional and Community Planning
2103 Seaton Hall

Proposal Number: 9931

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 10/29/2019

RE: Proposal Entitled, "Yellowstone For All: Creating an immersive, universal design experience at Mammoth Hot Springs"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

203 Fairchild Hall, Lower Mezzanine, 1601 Vattier St., Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278
comply@k-state.edu | k-state.edu/comply